Cloudera DataFlow for Data Hub 7.2.11

Apache NiFi User Guide

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Contents

Introduction

Apache NiFi is a dataflow system based on the concepts of flow-based programming. It supports powerful and scalable directed graphs of data routing, transformation, and system mediation logic. NiFi has a web-based user interface for design, control, feedback, and monitoring of dataflows. It is highly configurable along several dimensions of quality of service, such as loss-tolerant versus guaranteed delivery, low latency versus high throughput, and priority-based queuing. NiFi provides fine-grained data provenance for all data received, forked, joined cloned, modified, sent, and ultimately dropped upon reaching its configured end-state.

See the NiFi System Administrator's Guide for information about system requirements, installation, and configuration. Once NiFi is installed, use a supported web browser to view the UI.

Browser Support

Browser	Version
Chrome	Current and Current - 1
FireFox	Current and Current - 1
Edge	Current and Current - 1
Safari	Current and Current - 1

Current and Current - 1 indicates that the UI is supported in the current stable release of that browser and the preceding one. For instance, if the current stable release is 45.X then the officially supported versions will be 45.X and 44.X.

For Safari, which releases major versions much less frequently, Current and Current - 1 simply represent the two latest releases.

The supported browser versions are driven by the capabilities the UI employs and the dependencies it uses. UI features will be developed and tested against the supported browsers. Any problem using a supported browser should be reported to Apache NiFi.

Unsupported Browsers

While the UI may run successfully in unsupported browsers, it is not actively tested against them. Additionally, the UI is designed as a desktop experience and is not currently supported in mobile browsers.

Viewing the UI in Variably Sized Browsers

In most environments, all of the UI is visible in your browser. However, the UI has a responsive design that allows you to scroll through screens as needed, in smaller sized browsers or tablet environments.

In environments where your browser width is less than 800 pixels and the height less than 600 pixels, portions of the UI may become unavailable.

Terminology

DataFlow Manager

A DataFlow Manager (DFM) is a NiFi user who has permissions to add, remove, and modify components of a NiFi dataflow.

FlowFile

The FlowFile represents a single piece of data in NiFi. A FlowFile is made up of two components: FlowFile Attributes and FlowFile Content. Content is the data that is represented by the FlowFile. Attributes are characteristics that provide information or context about the data; they are made up of key-value pairs. All FlowFiles have the following Standard Attributes:

- uuid: A Universally Unique Identifier that distinguishes the FlowFile from other FlowFiles in the system.
- filename: A human-readable filename that may be used when storing the data to disk or in an external service
- path: A hierarchically structured value that can be used when storing data to disk or an external service so that the data is not stored in a single directory

Processor

The Processor is the NiFi component that is used to listen for incoming data; pull data from external sources; publish data to external sources; and route, transform, or extract information from FlowFiles.

Relationship

Each Processor has zero or more Relationships defined for it. These Relationships are named to indicate the result of processing a FlowFile. After a Processor has finished processing a FlowFile, it will route (or "transfer") the FlowFile to one of the Relationships. A DFM is then able to connect each of these Relationships to other components in order to specify where the FlowFile should go next under each potential processing result.

Connection

A DFM creates an automated dataflow by dragging components from the Components part of the NiFi toolbar to the canvas and then connecting the components together via Connections. Each connection consists of one or more Relationships. For each Connection that is drawn, a DFM can determine which Relationships should be used for the Connection. This allows data to be routed in different ways based on its processing outcome. Each connection houses a FlowFile Queue. When a FlowFile is transferred to a particular Relationship, it is added to the queue belonging to the associated Connection.

Controller Service

Controller Services are extension points that, after being added and configured by a DFM in the User Interface, will start up when NiFi starts up and provide information for use by other components (such as processors or other controller services). A common Controller Service used by several components is the StandardSSLContextService. It provides the ability to configure keystore and/or truststore properties once and reuse that configuration throughout the application. The idea is that, rather than configure this information in every processor that might need it, the controller service provides it for any processor to use as needed.

Reporting Task

Reporting Tasks run in the background to provide statistical reports about what is happening in the NiFi instance. The DFM adds and configures Reporting Tasks in the User Interface as desired. Common reporting tasks include the ControllerStatusReportingTask, MonitorDiskUsage reporting task, MonitorMemory reporting task, and the StandardGangliaReporter.

Funnel

A funnel is a NiFi component that is used to combine the data from several Connections into a single Connection.

Process Group

When a dataflow becomes complex, it often is beneficial to reason about the dataflow at a higher, more abstract level. NiFi allows multiple components, such as Processors, to be grouped together into a Process Group. The NiFi User Interface then makes it easy for a DFM to connect together multiple Process Groups into a logical dataflow, as well as allowing the DFM to enter a Process Group in order to see and manipulate the components within the Process Group.

Port

Dataflows that are constructed using one or more Process Groups need a way to connect a Process Group to other dataflow components. This is achieved by using Ports. A DFM can add any number of Input Ports and Output Ports to a Process Group and name these ports appropriately.

Remote Process Group

Just as data is transferred into and out of a Process Group, it is sometimes necessary to transfer data from one instance of NiFi to another. While NiFi provides many different mechanisms for transferring data from one system to another, Remote Process Groups are often the easiest way to accomplish this if transferring data to another instance of NiFi.

Bulletin

The NiFi User Interface provides a significant amount of monitoring and feedback about the current status of the application. In addition to rolling statistics and the current status provided for each component, components are able to report Bulletins. Whenever a component reports a Bulletin, a bulletin icon is displayed on that component. System-level bulletins are displayed on the Status bar near the top of the page. Using the mouse to hover over that icon will provide a tool-tip that shows the time and severity (Debug, Info, Warning, Error) of the Bulletin, as well as the message of the Bulletin. Bulletins from all components can also be viewed and filtered in the Bulletin Board Page, available in the Global Menu.

Template

Often times, a dataflow is comprised of many sub-flows that could be reused. NiFi allows DFMs to select a part of the dataflow (or the entire dataflow) and create a Template. This Template is given a name and can then be dragged onto the canvas just like the other components. As a result, several components may be combined together to make a larger building block from which to create a dataflow. These templates can also be exported as XML and imported into another NiFi instance, allowing these building blocks to be shared.

flow.xml.gz

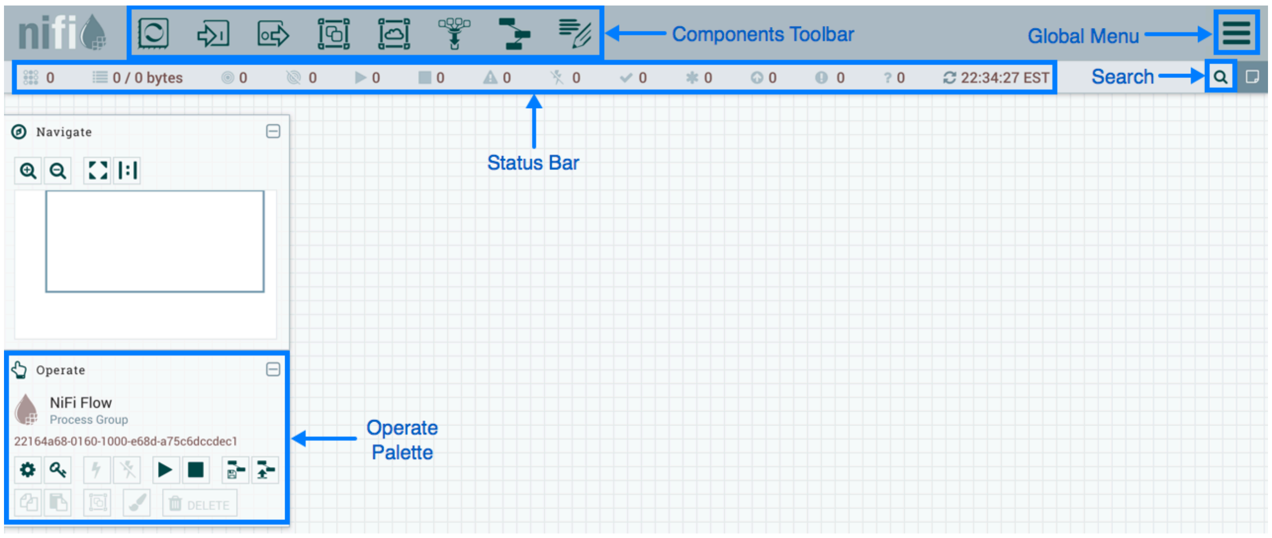
Everything the DFM puts onto the NiFi User Interface canvas is written, in real time, to one file called the flow.xml.gz. This file is located in the nifi/conf directory by default. Any change made on the canvas is automatically saved to this file, without the user needing to click a "Save" button. In addition, NiFi automatically creates a backup copy of this file in the archive directory when it is updated. You can use these archived files to rollback flow configuration. To do so, stop NiFi, replace flow.xml.gz with a desired backup copy, then restart NiFi. In a clustered environment, stop the entire NiFi cluster, replace the flow.xml.gz of one of nodes, and restart the node. Remove flow.xml.gz from other nodes. Once you confirmed the node starts up as a one-node cluster, start the other nodes. The replaced flow configuration will be synchronized across the cluster. The name and location of flow.xml.gz, and auto archive behavior are configurable. See the NiFi System Administrator's Guide for further details.

NiFi User Interface

The NiFi UI provides mechanisms for creating automated dataflows, as well as visualizing, editing, monitoring, and administering those dataflows. The UI can be broken down into several segments, each responsible for different functionality of the application. This section provides screenshots of the application and highlights the different segments of the UI. Each segment is discussed in further detail later in the document.

When the application is started, the user is able to navigate to the UI by going to the default address of http://<host name>:8080/nifi in a web browser. There are no permissions configured by default, so anyone is able to view and modify the dataflow. For information on securing the system, see the NiFi System Administrator’s Guide.

When a DFM navigates to the UI for the first time, a blank canvas is provided on which a dataflow can be built:

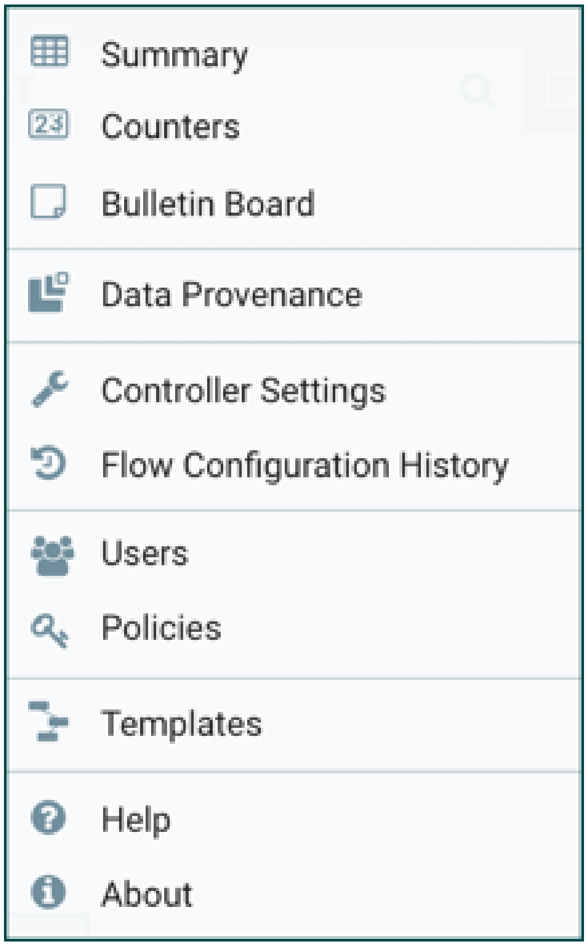


The Components Toolbar runs across the top left portion of your screen. It consists of the components you can drag onto the canvas to build your dataflow. Each component is described in more detail in 9243981bc34267c7ff4fd1eb910e2420631d8727.html#building-dataflow.

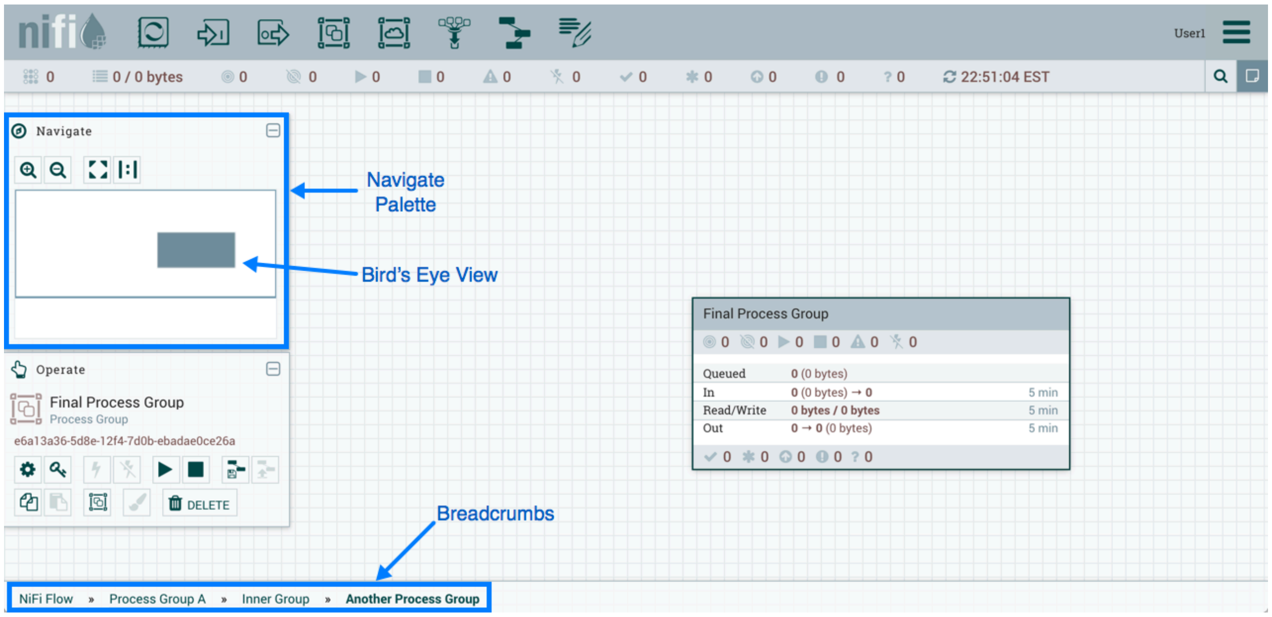
The Status Bar is under the Components Toolbar. The Status bar provides information about the number of threads that are currently active in the flow, the amount of data that currently exists in the flow, how many Remote Process Groups exist on the canvas in each state (Transmitting, Not Transmitting), how many Processors exist on the canvas in each state (Stopped, Running, Invalid, Disabled), how many versioned Process Groups exist on the canvas in each state (Up to date, Locally modified, Stale, Locally modified and stale, Sync failure) and the timestamp at which all of this information was last refreshed. Additionally, if the instance of NiFi is clustered, the Status bar shows how many nodes are in the cluster and how many are currently connected.

The Operate Palette sits to the left-hand side of the screen. It consists of buttons that are used by DFMs to manage the flow, as well as by administrators who manage user access and configure system properties, such as how many system resources should be provided to the application.

On the right side of the canvas is Search, and the Global Menu. You can use Search to easily find components on the canvas and to search by component name, type, identifier, configuration properties, and their values. The Global Menu contains options that allow you to manipulate existing components on the canvas:



Additionally, the UI has some features that allow you to easily navigate around the canvas. You can use the Navigate Palette to pan around the canvas, and to zoom in and out. The "Birds Eye View" of the dataflow provides a high-level view of the dataflow and allows you to pan across large portions of the dataflow. You can also find breadcrumbs along the bottom of the screen. As you navigate into and out of Process Groups, the breadcrumbs show the depth in the flow, and each Process Group that you entered to reach this depth. Each of the Process Groups listed in the breadcrumbs is a link that will take you back up to that level in the flow.



Accessing the UI with Multi-Tenant Authorization

Multi-tenant authorization enables multiple groups of users (tenants) to command, control, and observe different parts of the dataflow, with varying levels of authorization. When an authenticated user attempts to view or modify a NiFi resource, the system checks whether the user has privileges to perform that action. These privileges are defined by policies that you can apply system wide or to individual components. What this means from a Dataflow Manager perspective is that once you have access to the NiFi canvas, a range of functionality is visible and available to you, depending on the privileges assigned to you.

The available global access policies are:

Policy	Privilege
view the UI	Allows users to view the UI
access the controller	Allows users to view and modify the controller including reporting tasks, Controller Services, and nodes in the cluster
query provenance	Allows users to submit a provenance search and request even lineage
access restricted components	Allows users to create/modify restricted components assuming other permissions are sufficient. The restricted components may indicate which specific permissions are required. Permissions can be granted for specific restrictions or be granted regardless of restrictions. If permission is granted regardless of restrictions, the user can create/ modify all restricted components.
access all policies	Allows users to view and modify the policies for all components
access users/groups	Allows users to view and modify the users and user groups
retrieve site-to-site details	Allows other NiFi instances to retrieve Site-To-Site details
view system diagnostics	Allows users to view System Diagnostics
proxy user requests	Allows proxy machines to send requests on the behalf of others
access counters	Allows users to view and modify counters

The available component-level access policies are:

Policy	Privilege
view the component	Allows users to view component configuration details
modify the component	Allows users to modify component configuration details
view provenance	Allows users to view provenance events generated by this component
view the data	Allows users to view metadata and content for this component in flowfile queues in outbound connections and through provenance events
modify the data	Allows users to empty flowfile queues in outbound connections and submit replays through provenance events
view the policies	Allows users to view the list of users who can view and modify a component
modify the policies	Allows users to modify the list of users who can view and modify a component

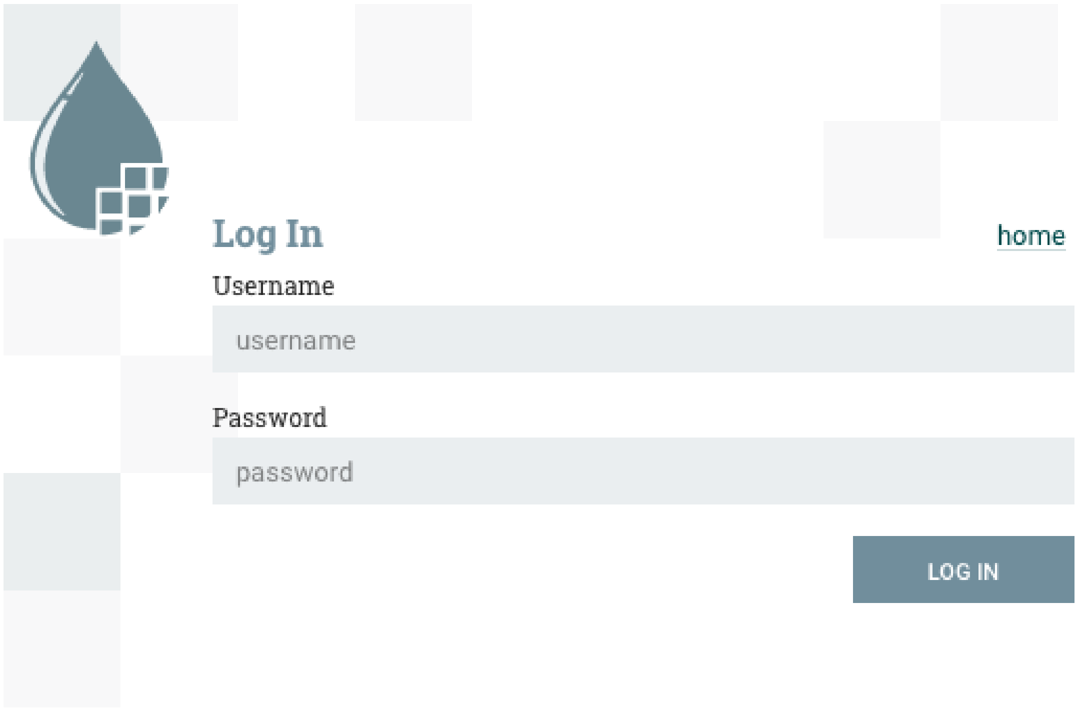
Policy	Privilege
retrieve data via site-to-site	Allows a port to receive data from NiFi instances
send data via site-to-site	Allows a port to send data from NiFi instances

If you are unable to view or modify a NiFi resource, contact your System Administrator or see Configuring Users and Access Policies in the NiFi System Administrator's Guide for more information.

Logging In

If NiFi is configured to run securely, users will be able to request access to the DataFlow. For information on configuring NiFi to run securely, see the NiFi System Administrator's Guide. If NiFi supports anonymous access, users will be given access accordingly and given an option to log in.

Clicking the 'login' link will open the log in page. If the user is logging in with their username/password they will be presented with a form to do so. If NiFi is not configured to support anonymous access and the user is logging in with their username/password, they will be immediately sent to the login form bypassing the canvas.

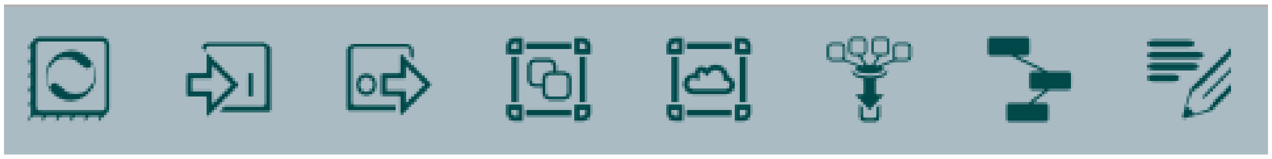


Building a DataFlow

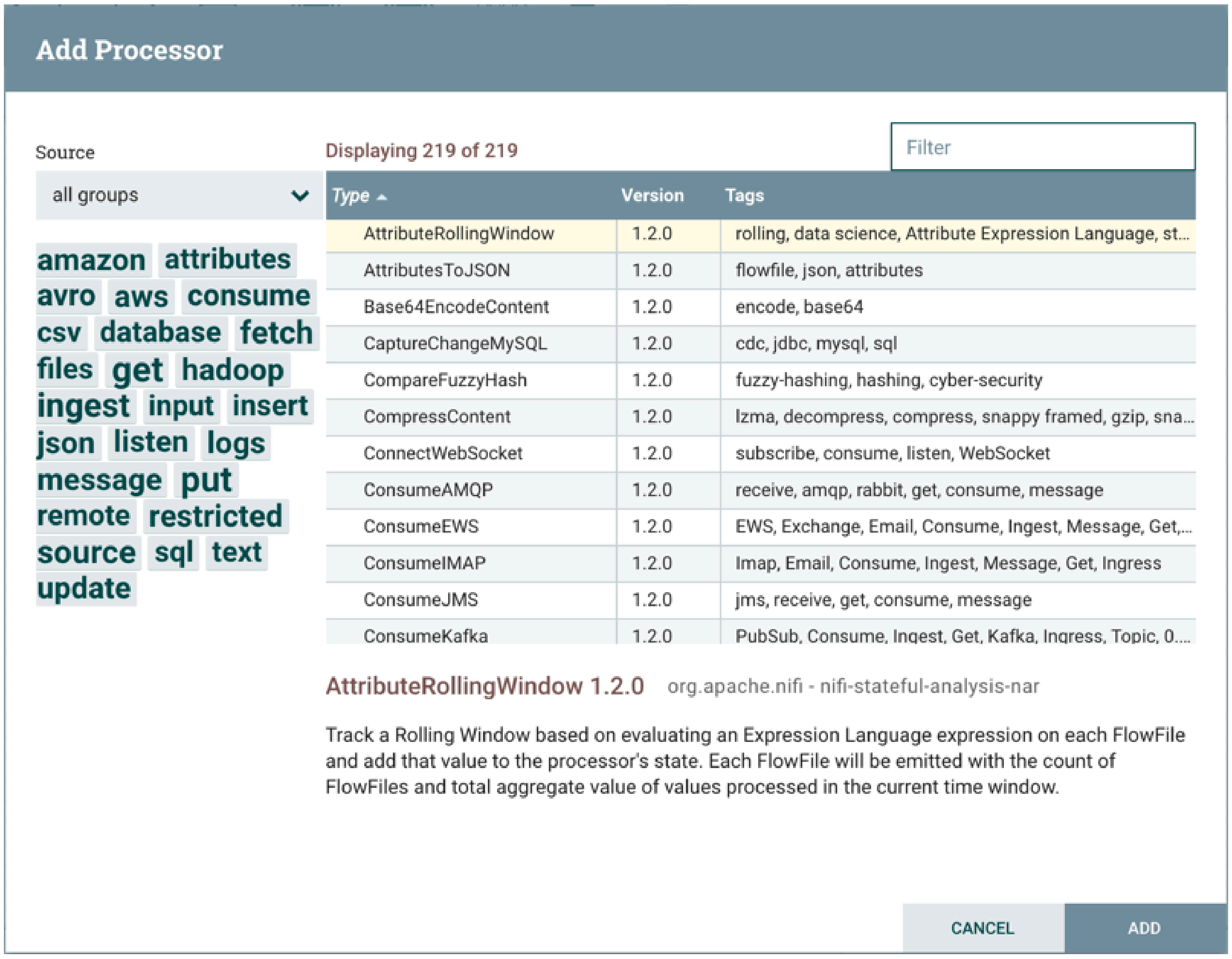
A DFM is able to build an automated dataflow using the NiFi UI. Simply drag components from the toolbar to the canvas, configure the components to meet specific needs, and connect the components together.

Adding Components to the Canvas

The User Interface section above outlined the different segments of the UI and pointed out a Components Toolbar. This section looks at each of the Components in that toolbar:



Processor: The Processor is the most commonly used component, as it is responsible for data ingress, egress, routing, and manipulating. There are many different types of Processors. In fact, this is a very common Extension Point in NiFi, meaning that many vendors may implement their own Processors to perform whatever functions are necessary for their use case. When a Processor is dragged onto the canvas, the user is presented with a dialog to choose which type of Processor to use:



Add Processor

Source

all groups

amazon attributes avro aws consume csv database fetch files get hadoop ingest input insert json listen logs message put remote restricted source sql text update

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Filter

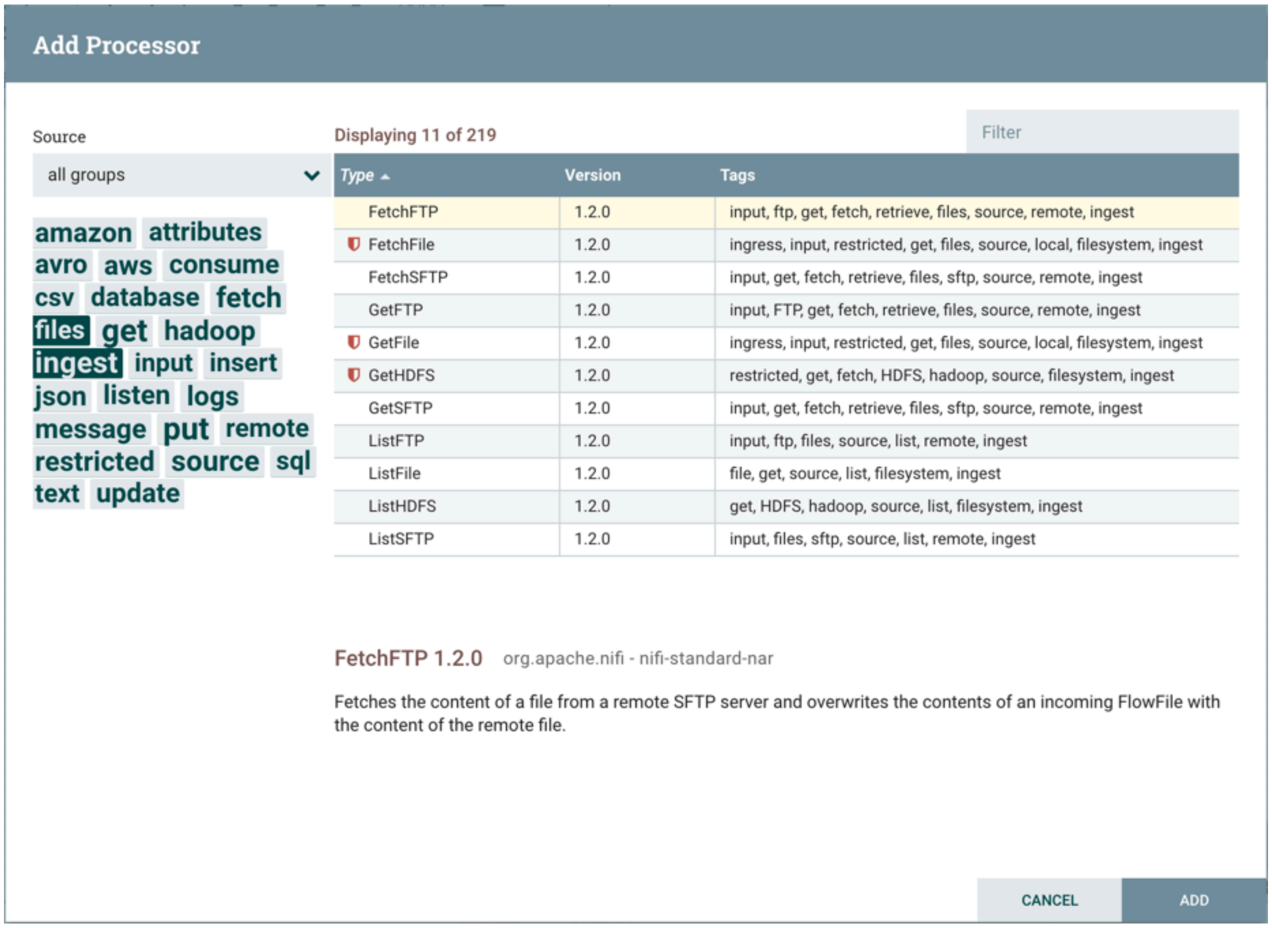
Type	Version	Tags
AttributeRollingWindow	1.2.0	rolling, data science, Attribute Expression Language, st...
AttributesToJSON	1.2.0	flowfile, json, attributes
Base64EncodeContent	1.2.0	encode, base64
CaptureChangeMySQL	1.2.0	cdc, jdbc, mysql, sql
CompareFuzzyHash	1.2.0	fuzzy-hashing, hashing, cyber-security
CompressContent	1.2.0	lzma, decompress, compress, snappy framed, gzip, sna...
ConnectWebSocket	1.2.0	subscribe, consume, listen, WebSocket
ConsumeAMQP	1.2.0	receive, amqp, rabbit, get, consume, message
ConsumeEWS	1.2.0	EWS, Exchange, Email, Consume, Ingest, Message, Get,...
ConsumeIMAP	1.2.0	Imap, Email, Consume, Ingest, Message, Get, Ingress
ConsumeJMS	1.2.0	jms, receive, get, consume, message
ConsumeKafka	1.2.0	PubSub, Consume, Ingest, Get, Kafka, Ingress, Topic, 0....

AttributeRollingWindow 1.2.0 org.apache.nifi - nifi-stateful-analysis-nar

Track a Rolling Window based on evaluating an Expression Language expression on each FlowFile and add that value to the processor's state. Each FlowFile will be emitted with the count of FlowFiles and total aggregate value of values processed in the current time window.

CANCEL ADD

In the top-right corner, the user is able to filter the list based on the Processor Type or the Tags associated with a Processor. Processor developers have the ability to add Tags to their Processors. These tags are used in this dialog for filtering and are displayed on the left-hand side in a Tag Cloud. The more Processors that exist with a particular Tag, the larger the Tag appears in the Tag Cloud. Clicking a Tag in the Cloud will filter the available Processors to only those that contain that Tag. If multiple Tags are selected, only those Processors that contain all of those Tags are shown. For example, if we want to show only those Processors that allow us to ingest files, we can select both the files Tag and the ingest Tag:


Add Processor
Source
all groups
amazon attributes avro aws consume csv database fetch files get hadoop ingest input insert json listen logs message put remote restricted source sql text update
Filter
CANCEL
ADD

Displaying 11 of 219

Type	Version	Tags
FetchFTP	1.2.0	input, ftp, get, fetch, retrieve, files, source, remote, ingest
FetchFile	1.2.0	ingress, input, restricted, get, files, source, local, filesystem, ingest
FetchSFTP	1.2.0	input, get, fetch, retrieve, files, sftp, source, remote, ingest
GetFTP	1.2.0	input, FTP, get, fetch, retrieve, files, source, remote, ingest
GetFile	1.2.0	ingress, input, restricted, get, files, source, local, filesystem, ingest
GetHDFS	1.2.0	restricted, get, fetch, HDFS, hadoop, source, filesystem, ingest
GetSFTP	1.2.0	input, get, fetch, retrieve, files, sftp, source, remote, ingest
ListFTP	1.2.0	input, ftp, files, source, list, remote, ingest
ListFile	1.2.0	file, get, source, list, filesystem, ingest
ListHDFS	1.2.0	get, HDFS, hadoop, source, list, filesystem, ingest
ListSFTP	1.2.0	input, files, sftp, source, list, remote, ingest

FetchFTP 1.2.0 org.apache.nifi - nifi-standard-nar

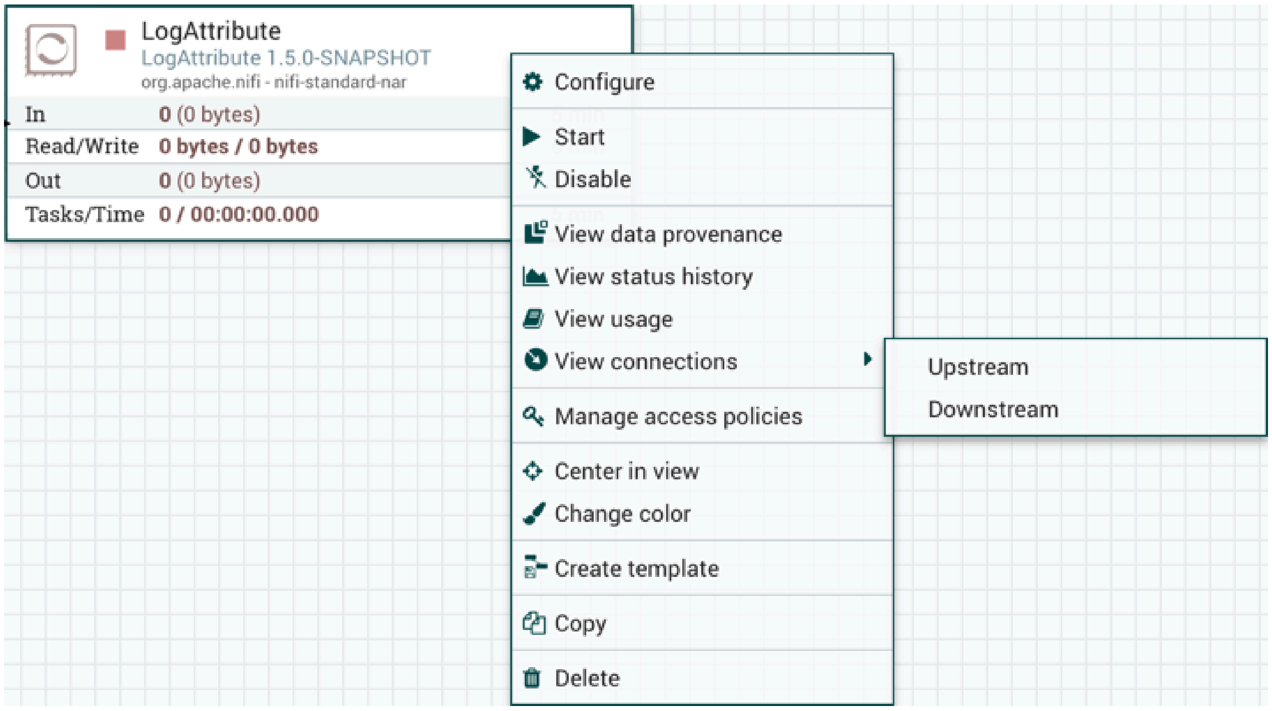
Fetches the content of a file from a remote SFTP server and overwrites the contents of an incoming FlowFile with the content of the remote file.

Restricted components will be marked with a icon next to their name. These are components that can be used to execute arbitrary unsanitized code provided by the operator through the NiFi REST API/UI or can be used to obtain or alter data on the NiFi host system using the NiFi OS credentials. These components could be used by an otherwise authorized NiFi user to go beyond the intended use of the application, escalate privilege, or could expose data about the internals of the NiFi process or the host system. All of these capabilities should be considered privileged, and admins should be aware of these capabilities and explicitly enable them for a subset of trusted users. Before a user is allowed to create and modify restricted components they must be granted access. Hovering over the icon will display the specific permissions a restricted component requires. Permissions can be assigned regardless of restrictions. In this case, the user will have access to all restricted components. Alternatively, users can be assigned access to specific restrictions. If the user has been granted access to all restrictions a component requires, they will have access to that component assuming otherwise sufficient permissions. For more information refer to *Accessing the UI with Multi-Tenant Authorization and Restricted Components in Versioned Flows*.

Clicking the "Add" button or double-clicking on a Processor Type will add the selected Processor to the canvas at the location that it was dropped.

Note: For any component added to the canvas, it is possible to select it with the mouse and move it anywhere on the canvas. Also, it is possible to select multiple items at once by either holding down the Shift key and selecting each item or by holding down the Shift key and dragging a selection box around the desired components.

Once you have dragged a Processor onto the canvas, you can interact with it by right-clicking on the Processor and selecting an option from the context menu. The options available to you from the context menu vary, depending on the privileges assigned to you.



While the options available from the context menu vary, the following options are typically available when you have full privileges to work with a Processor:

- Configure: This option allows the user to establish or change the configuration of the Processor (see dc5a9d329c25c5a74da42ee4d98a3819302d02f3.html#Configuring_a_Processor).

Note: For Processors, Ports, Remote Process Groups, Connections and Labels, it is possible to open the configuration dialog by double-clicking on the desired component.

- Start or Stop: This option allows the user to start or stop a Processor; the option will be either Start or Stop, depending on the current state of the Processor.
- Enable or Disable: This option allows the user to enable or disable a Processor; the option will be either Enable or Disable, depending on the current state of the Processor.
- View data provenance: This option displays the NiFi Data Provenance table, with information about data provenance events for the FlowFiles routed through that Processor (see a247a778bcf38f6ecb24f67a21861ffd983ded4c.html#data_provenance).
- View status history: This option opens a graphical representation of the Processor's statistical information over time.
- View usage: This option takes the user to the Processor's usage documentation.
- View connections#Upstream: This option allows the user to see and "jump to" upstream connections that are coming into the Processor. This is particularly useful when processors connect into and out of other Process Groups.
- View connections#Downstream: This option allows the user to see and "jump to" downstream connections that are going out of the Processor. This is particularly useful when processors connect into and out of other Process Groups.
- Center in view: This option centers the view of the canvas on the given Processor.
- Change color: This option allows the user to change the color of the Processor, which can make the visual management of large flows easier.
- Create template: This option allows the user to create a template from the selected Processor.
- Copy: This option places a copy of the selected Processor on the clipboard, so that it may be pasted elsewhere on the canvas by right-clicking on the canvas and selecting Paste. The Copy/Paste actions also may be done using the keystrokes Ctrl-C (Command-C) and Ctrl-V (Command-V).
- Delete: This option allows the DFM to delete a Processor from the canvas.

Input Port: Input Ports provide a mechanism for transferring data into a Process Group. When an Input Port is dragged onto the canvas, the DFM is prompted to name the Port. All Ports within a Process Group must have unique names.

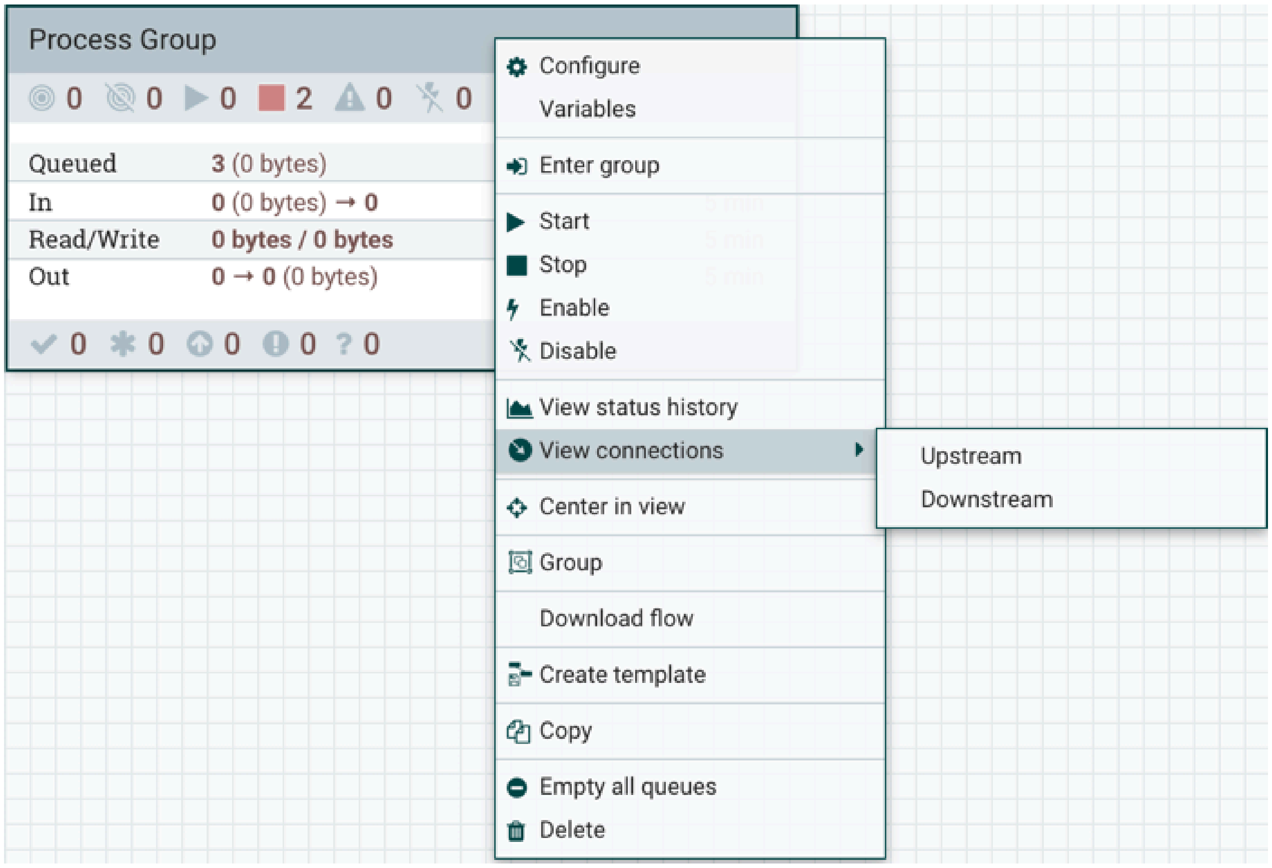
All components exist only within a Process Group. When a user initially navigates to the NiFi page, the user is placed in the Root Process Group. If the Input Port is dragged onto the Root Process Group, the Input Port provides a mechanism to receive data from remote instances of NiFi via Site to Site. In this case, the Input Port can be configured to restrict access to appropriate users, if NiFi is configured to run securely. For information on configuring NiFi to run securely, see the NiFi System Administrator's Guide.

Output Port: Output Ports provide a mechanism for transferring data from a Process Group to destinations outside of the Process Group. When an Output Port is dragged onto the canvas, the DFM is prompted to name the Port. All Ports within a Process Group must have unique names.

If the Output Port is dragged onto the Root Process Group, the Output Port provides a mechanism for sending data to remote instances of NiFi via Site to Site. In this case, the Port acts as a queue. As remote instances of NiFi pull data from the port, that data is removed from the queues of the incoming Connections. If NiFi is configured to run securely, the Output Port can be configured to restrict access to appropriate users. For information on configuring NiFi to run securely, see the NiFi System Administrator's Guide.

Process Group: Process Groups can be used to logically group a set of components so that the dataflow is easier to understand and maintain. When a Process Group is dragged onto the canvas, the DFM is prompted to name the Process Group. The Process Group will then be nested within that parent group.

Once you have dragged a Process Group onto the canvas, you can interact with it by right-clicking on the Process Group and selecting an option from the context menu. The options available to you from the context menu vary, depending on the privileges assigned to you.



While the options available from the context menu vary, the following options are typically available when you have full privileges to work with the Process Group:

- Configure: This option allows the user to establish or change the configuration of the Process Group.
- Variables: This option allows the user to create or configure variables within the NiFi UI.
- Enter group: This option allows the user to enter the Process Group.

Note: It is also possible to double-click on the Process Group to enter it.

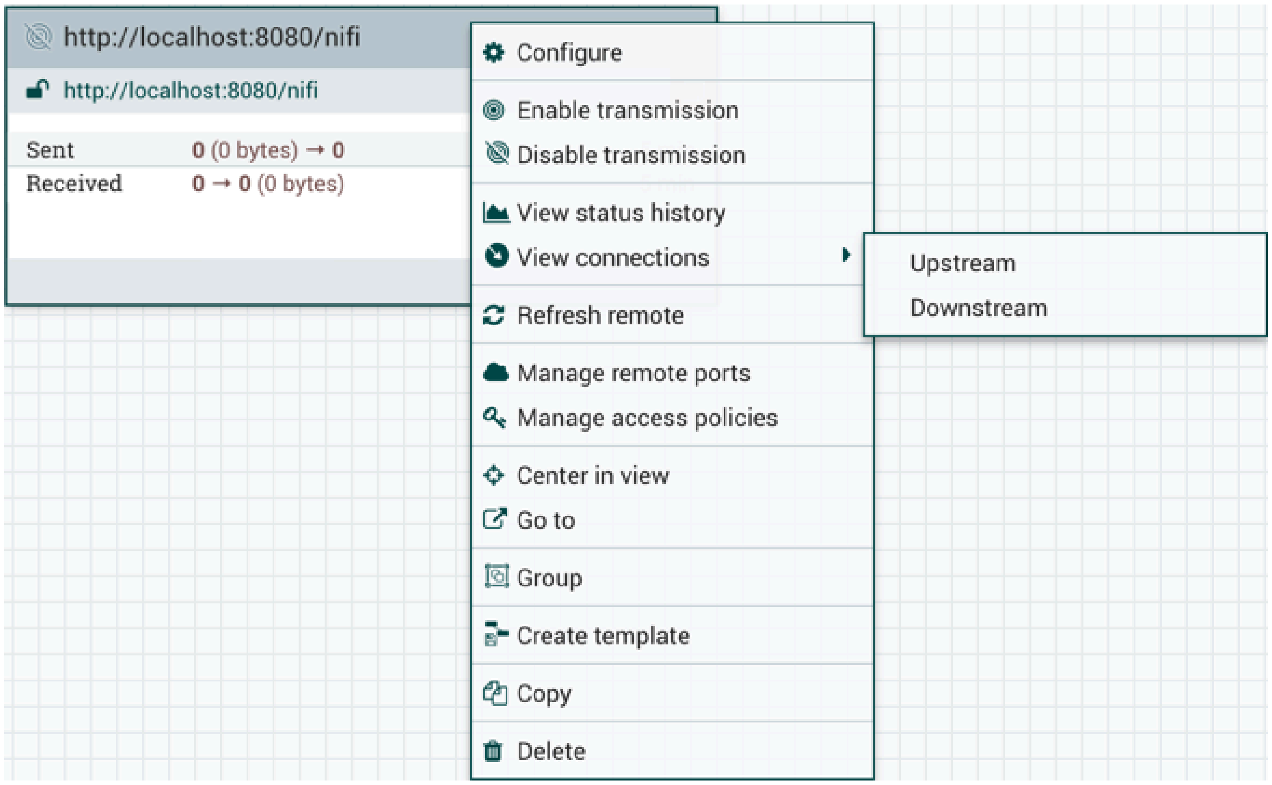
- Start: This option allows the user to start a Process Group.
- Stop: This option allows the user to stop a Process Group.
- Enable: This option allows the user to enable all Processors in the Process Group.
- Disable: This option allows the user to disable all Processors in the Process Group.
- View status history: This option opens a graphical representation of the Process Group's statistical information over time.
- View connections#Upstream: This option allows the user to see and "jump to" upstream connections that are coming into the Process Group.
- View connections#Downstream: This option allows the user to see and "jump to" downstream connections that are going out of the Process Group.
- Center in view: This option centers the view of the canvas on the given Process Group.
- Group: This option allows the user to create a new Process Group that contains the selected Process Group and any other components selected on the canvas.
- Download flow definition: This option allows the user to download the flow definition of the process group as a JSON file. The file can be used as a backup or imported into a NiFi Registry using the NiFi CLI. (Note: If "Download flow definition" is selected for a versioned process group, there is no versioning information in the download. In other words, the resulting contents of the JSON file is the same whether the process group is versioned or not.)

- Create template: This option allows the user to create a template from the selected Process Group.
- Copy: This option places a copy of the selected Process Group on the clipboard, so that it may be pasted elsewhere on the canvas by right-clicking on the canvas and selecting Paste. The Copy/Paste actions also may be done using the keystrokes Ctrl-C (Command-C) and Ctrl-V (Command-V).
- Empty all queues: This option allows the user to empty all queues in the selected Process Group. All FlowFiles from all connections waiting at the time of the request will be removed.
- Delete: This option allows the DFM to delete a Process Group.

Remote Process Group: Remote Process Groups appear and behave similar to Process Groups. However, the Remote Process Group (RPG) references a remote instance of NiFi. When an RPG is dragged onto the canvas, rather than being prompted for a name, the DFM is prompted for the URL of the remote NiFi instance. If the remote NiFi is a clustered instance, adding two or more cluster node URLs is recommended so that an initial connection can be made even if one of the nodes is unavailable. Multiple URLs can be specified in a comma-separated format.

When data is transferred to a clustered instance of NiFi via an RPG, the RPG will first connect to the remote instance whose URL is configured to determine which nodes are in the cluster and how busy each node is. This information is then used to load balance the data that is pushed to each node. The remote instances are then interrogated periodically to determine information about any nodes that are dropped from or added to the cluster and to recalculate the load balancing based on each node's load. For more information, see the section on Site-to-Site.

Once you have dragged a Remote Process Group onto the canvas, you can interact with it by right-clicking on the Remote Process Group and selecting an option from the context menu. The options available to you from the menu vary, depending on the privileges assigned to you.



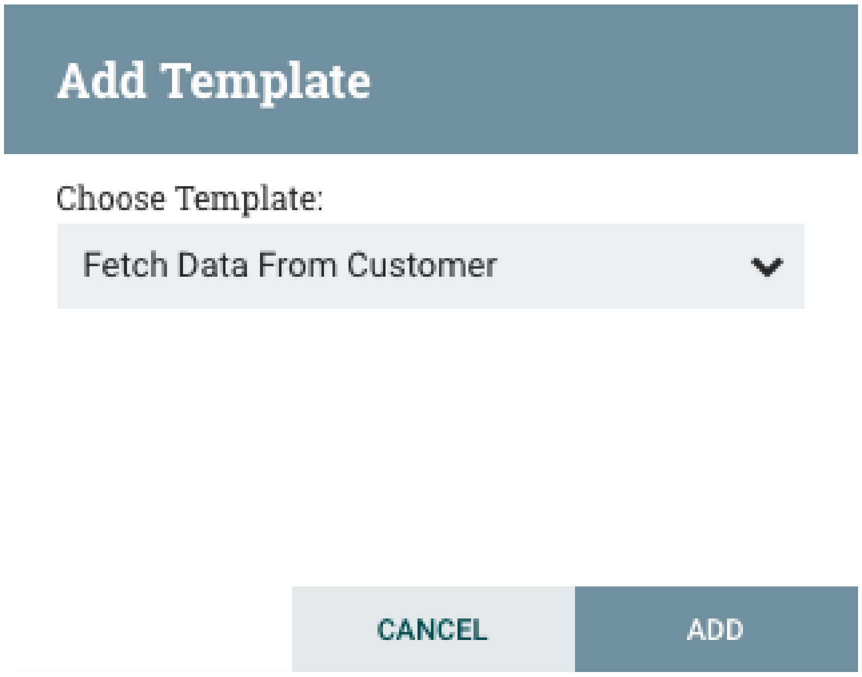
The following options are typically available when you have full privileges to work with the Remote Process Group:

- Configure: This option allows the user to establish or change the configuration of the Remote Process Group.
- Enable transmission: Makes the transmission of data between NiFi instances active (see Remote Process Group Transmission).
- Disable transmission: Disables the transmission of data between NiFi instances.

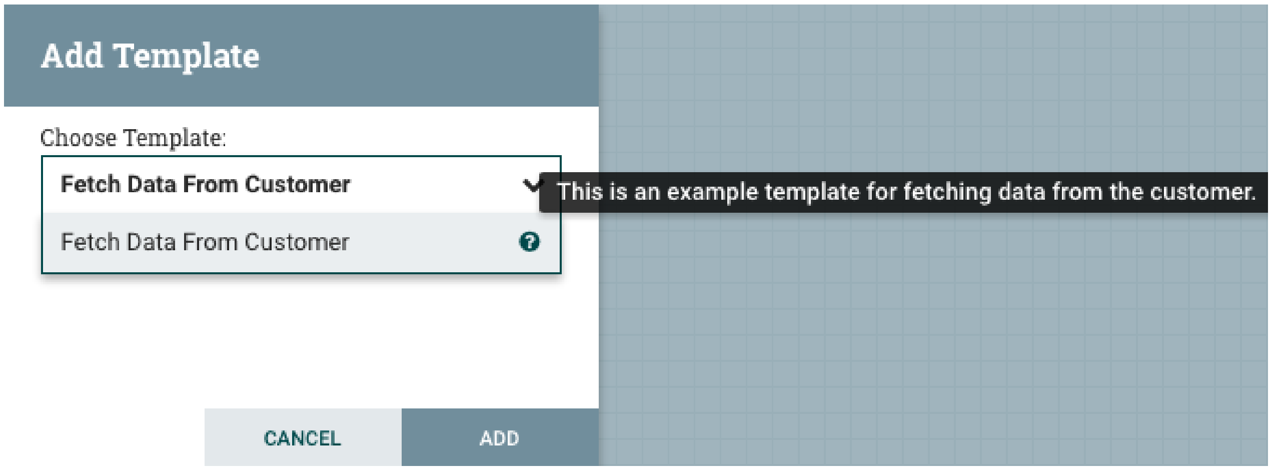
- View status history: This option opens a graphical representation of the Remote Process Group's statistical information over time.
- View connections#Upstream: This option allows the user to see and "jump to" upstream connections that are coming into the Remote Process Group.
- View connections#Downstream: This option allows the user to see and "jump to" downstream connections that are going out of the Remote Process Group.
- Refresh remote: This option refreshes the view of the status of the remote NiFi instance.
- Manage remote ports: This option allows the user to see input ports and/or output ports that exist on the remote instance of NiFi that the Remote Process Group is connected to. Note that if the Site-to-Site configuration is secure, only the ports that the connecting NiFi has been given accessed to will be visible.
- Center in view: This option centers the view of the canvas on the given Remote Process Group.
- Go to: This option opens a view of the remote NiFi instance in a new tab of the browser. Note that if the Site-to-Site configuration is secure, the user must have access to the remote NiFi instance in order to view it.
- Group: This option allows the user to create a new Process Group that contains the selected Remote Process Group and any other components selected on the canvas.
- Create template: This option allows the user to create a template from the selected Remote Process Group.
- Copy: This option places a copy of the selected Process Group on the clipboard, so that it may be pasted elsewhere on the canvas by right-clicking on the canvas and selecting Paste. The Copy/Paste actions also may be done using the keystrokes Ctrl-C (Command-C) and Ctrl-V (Command-V).
- Delete: This option allows the DFM to delete a Remote Process Group from the canvas.

Funnel: Funnels are used to combine the data from many Connections into a single Connection. This has two advantages. First, if many Connections are created with the same destination, the canvas can become cluttered if those Connections have to span a large space. By funneling these Connections into a single Connection, that single Connection can then be drawn to span that large space instead. Secondly, Connections can be configured with FlowFile Prioritizers. Data from several Connections can be funneled into a single Connection, providing the ability to Prioritize all of the data on that one Connection, rather than prioritizing the data on each Connection independently.

Template: Templates can be created by DFMs from sections of the flow, or they can be imported from other dataflows. These Templates provide larger building blocks for creating a complex flow quickly. When the Template is dragged onto the canvas, the DFM is provided a dialog to choose which Template to add to the canvas:



Clicking the drop-down box shows all available Templates. Any Template that was created with a description will show a question mark icon, indicating that there is more information. Hovering over the icon with the mouse will show this description:

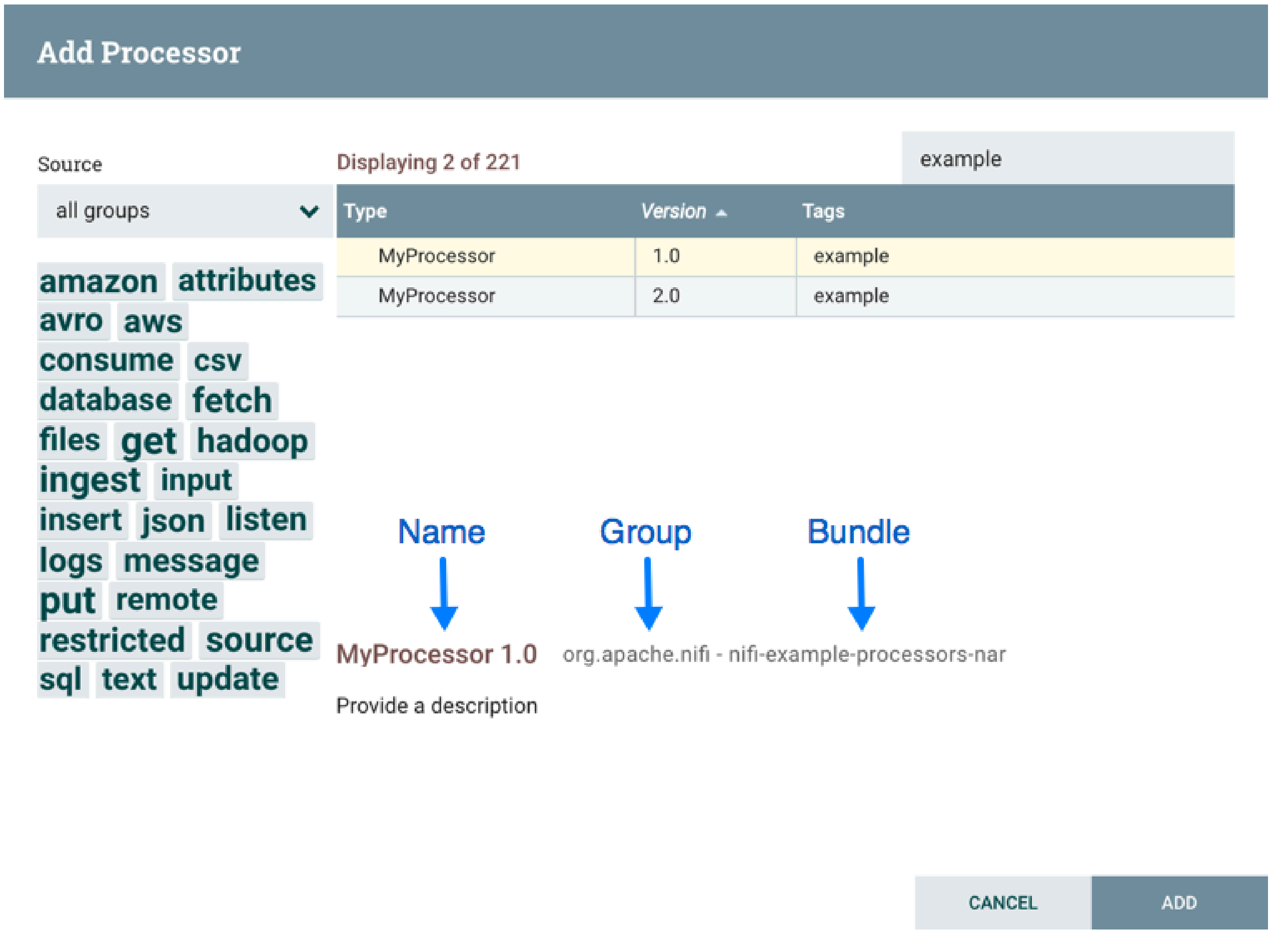


This is an example template for fetching data from the customer.

Label: Labels are used to provide documentation to parts of a dataflow. When a Label is dropped onto the canvas, it is created with a default size. The Label can then be resized by dragging the handle in the bottom-right corner. The Label has no text when initially created. The text of the Label can be added by right-clicking on the Label and choosing Configure.

Component Versions

You have access to information about the version of your Processors, Controller Services, and Reporting Tasks. This is especially useful when you are working within a clustered environment with multiple NiFi instances running different versions of a component or if you have upgraded to a newer version of a processor. The Add Processor, Add Controller Service, and Add Reporting Task dialogs include a column identifying the component version, as well as the name of the component, the organization or group that created the component, and the NAR bundle that contains the component.

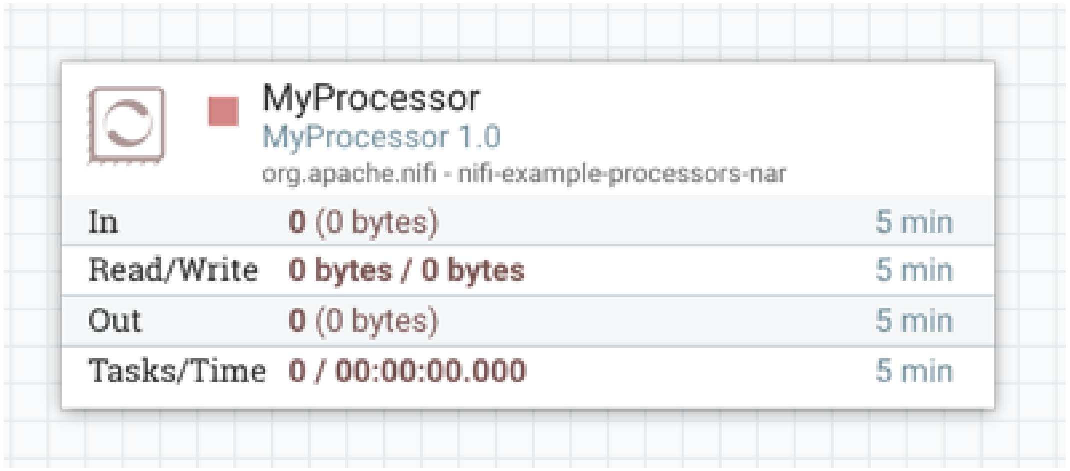

Add Processor
Source
all groups
amazon attributes avro aws consume csv database fetch files get hadoop ingest input insert json listen logs message put remote restricted source sql text update
Displaying 2 of 221
example
Name
Group
Bundle
CANCEL
ADD

Type	Version	Tags
MyProcessor	1.0	example
MyProcessor	2.0	example

MyProcessor 1.0 org.apache.nifi - nifi-example-processors-nar

Provide a description

Each component displayed on the canvas also contains this information.



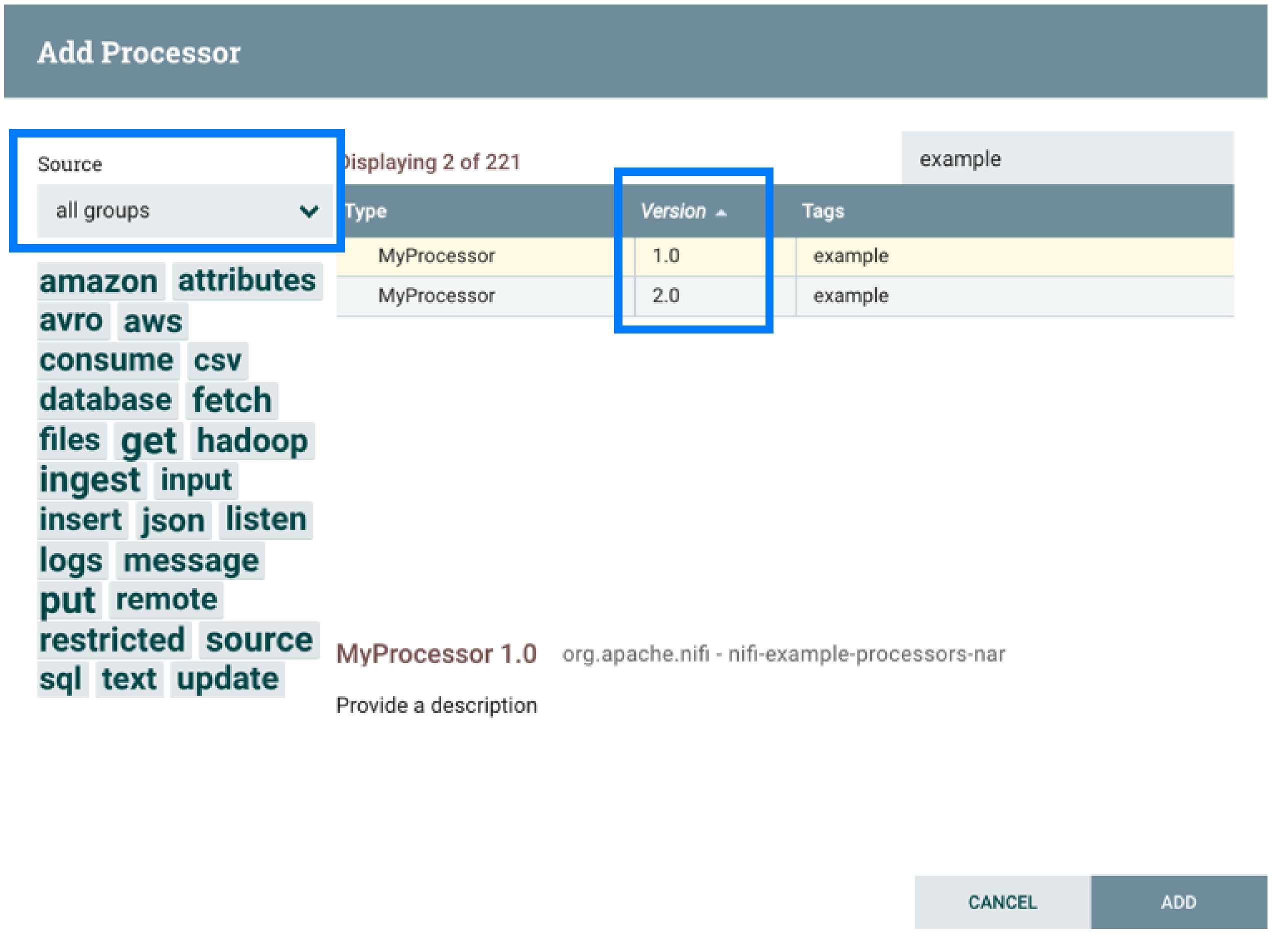
In	0 (0 bytes)	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 (0 bytes)	5 min
Tasks/Time	0 / 00:00:00.000	5 min

Sorting and Filtering Components

When you are adding a component, you can sort on version number or filter based on originating source.

To sort based on version, click the version column to display in ascending or descending version order.

To filter based on source group, click the source drop-down in the upper left of your Add Component dialog, and select the group you want to view.


Add Processor
Source
all groups
Displaying 2 of 221
example
amazon attributes avro aws consume csv database fetch files get hadoop ingest input insert json listen logs message put remote restricted source sql text update
CANCEL
ADD

Type	Version	Tags
MyProcessor	1.0	example
MyProcessor	2.0	example

MyProcessor 1.0 org.apache.nifi - nifi-example-processors-nar

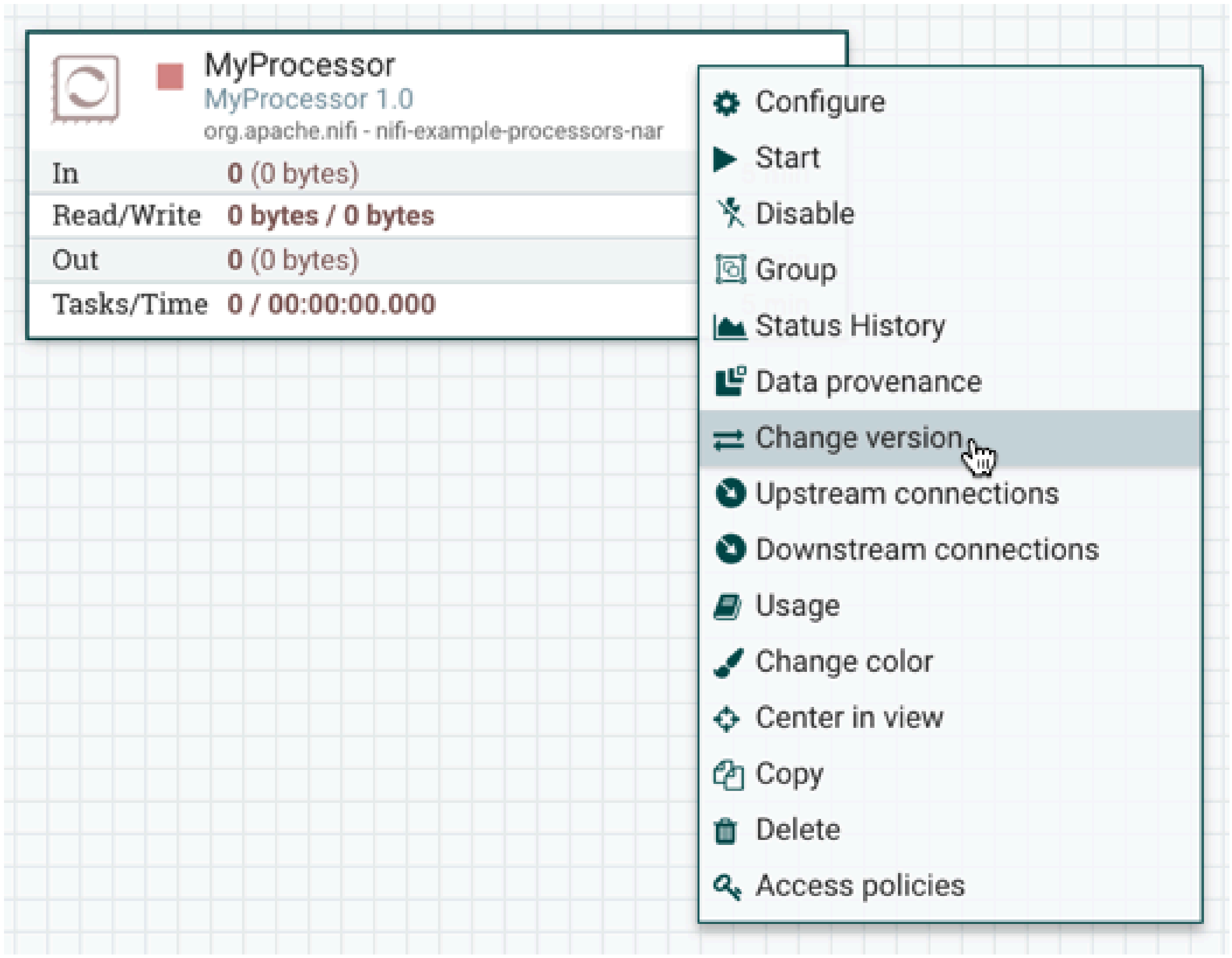
Provide a description

Changing Component Versions

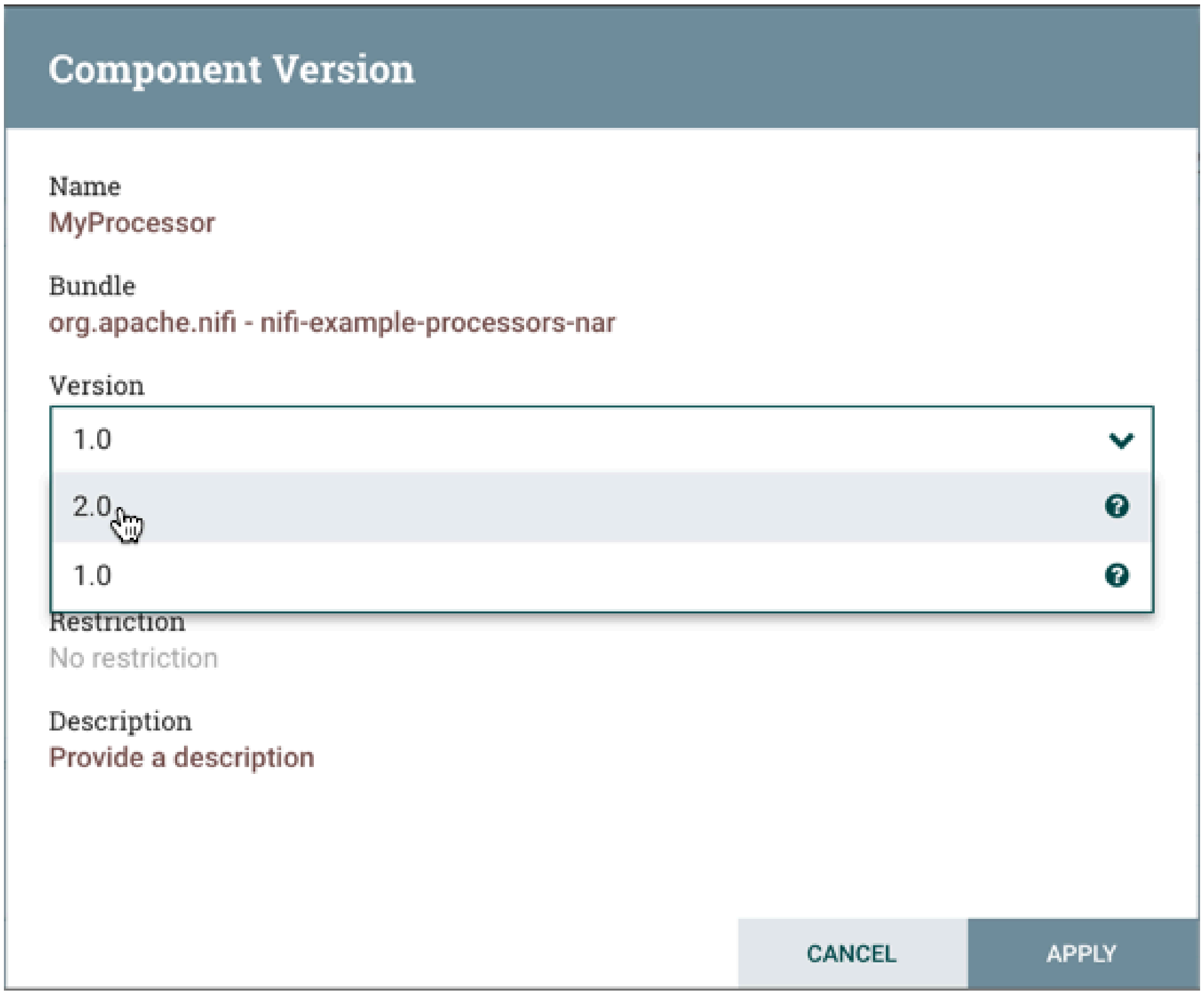
To change a component version, perform the following steps.

1. Right-click the component on the canvas to display configuration options.

2. Select Change version.



3. In the Component Version dialog, select the version you want to run from the Version drop-down menu.



Component Version

Name
MyProcessor

Bundle
org.apache.nifi - nifi-example-processors-nar

Version
1.0

2.0

1.0

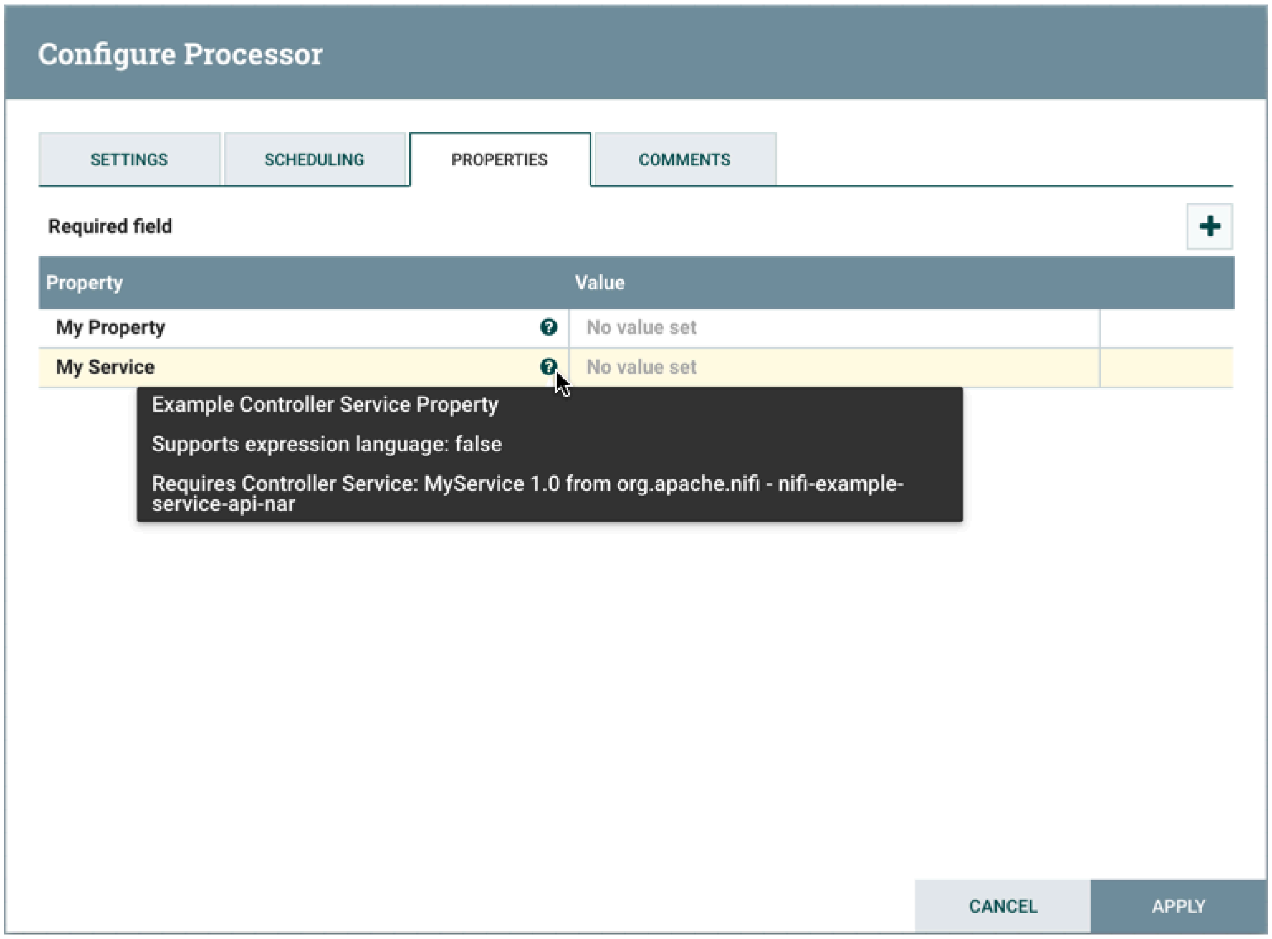
Restriction
No restriction

Description
Provide a description

Understanding Version Dependencies

When you are configuring a component, you can also view information about version dependencies.

1. Right-click your component and select Configure to display the Configure dialog for your component.
2. Click the Properties tab.
3. Click the information icon to view any version dependency information.



Required field

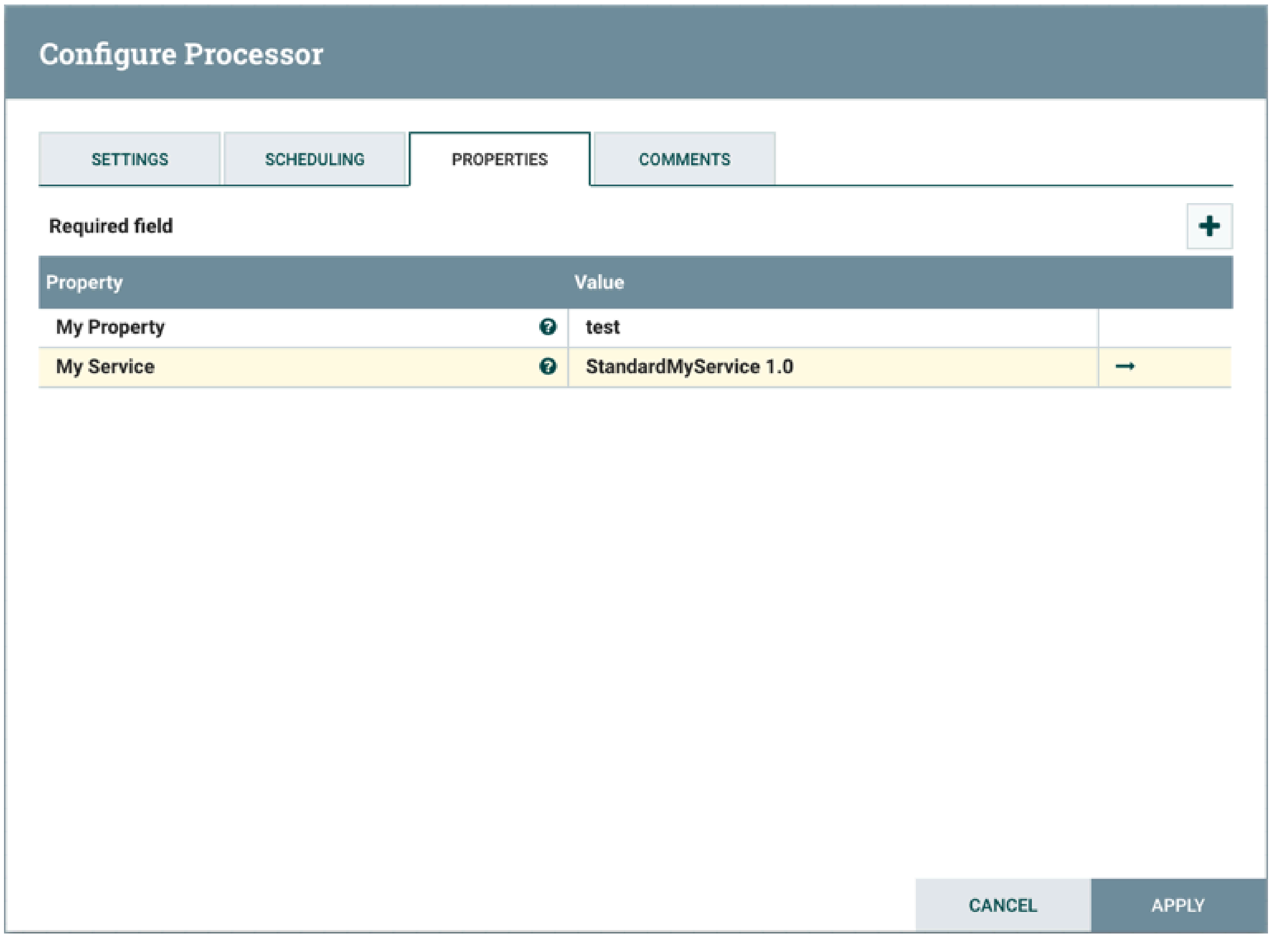
Property	Value
My Property	No value set
My Service	No value set

Example Controller Service Property

Supports expression language: false

Requires Controller Service: MyService 1.0 from org.apache.nifi - nifi-example-service-api-nar

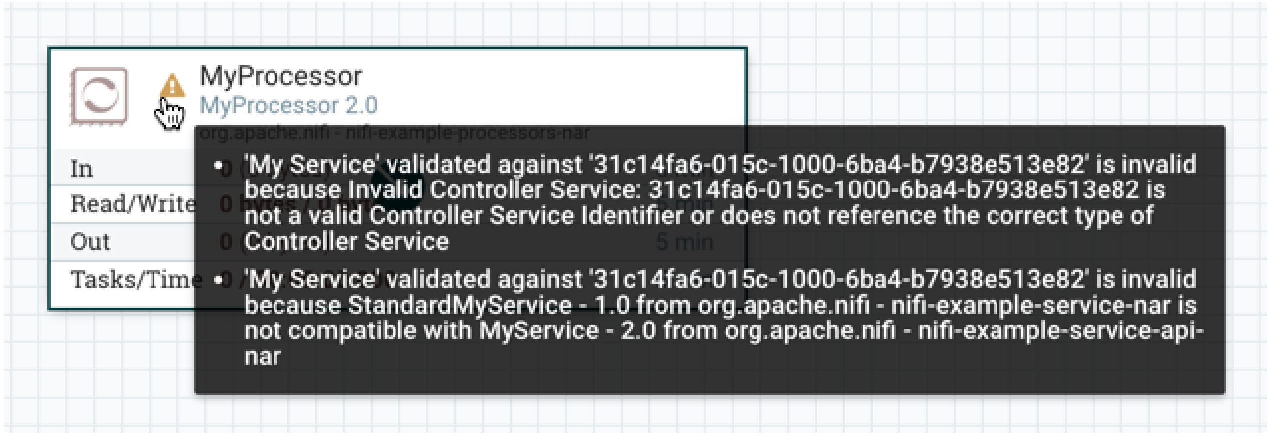
In the following example, MyProcessor version 1.0 is configured properly with the controller service StandardMyService version 1.0:



Required field

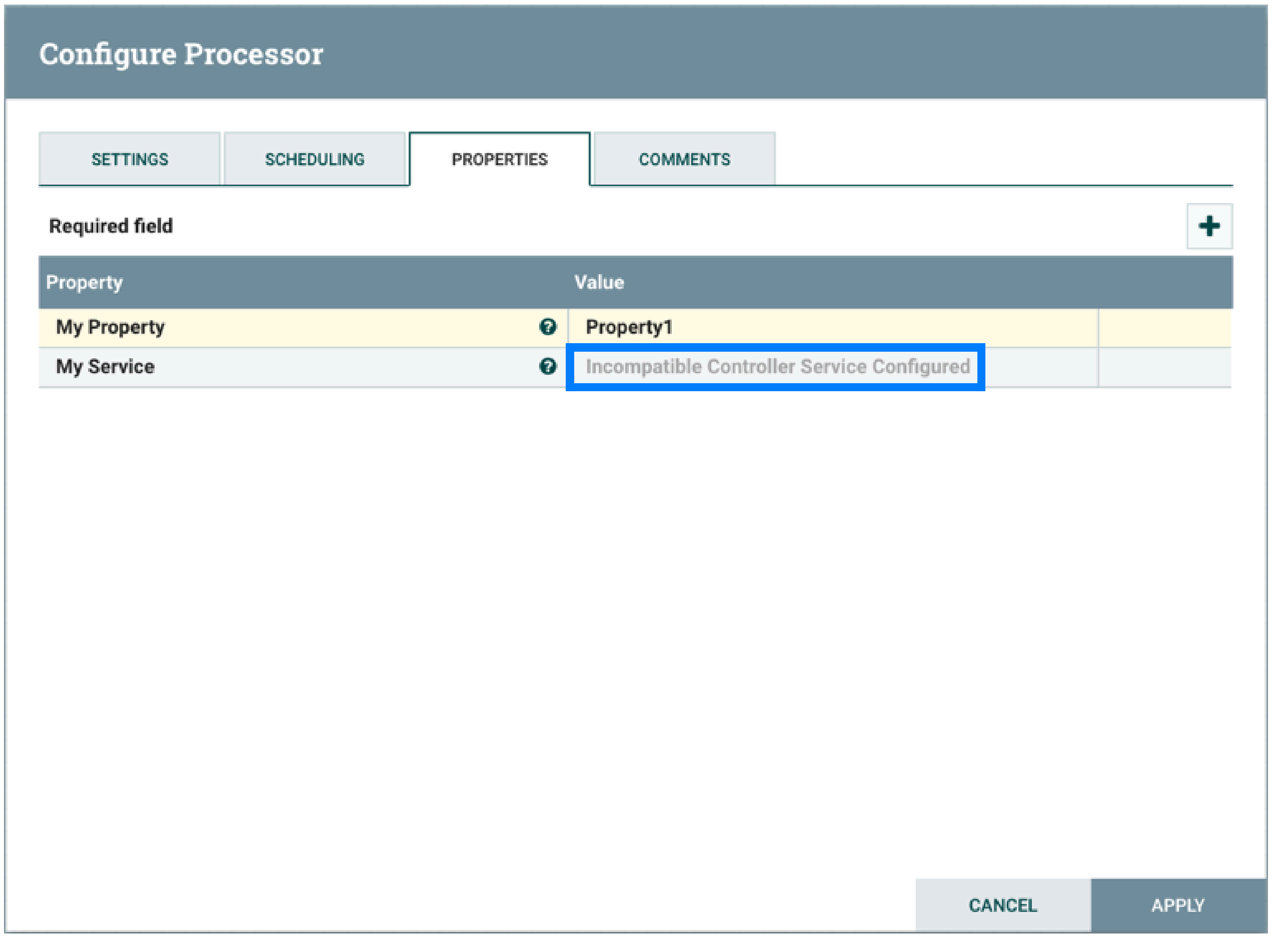
Property	Value
My Property	test
My Service	StandardMyService 1.0

If the version of MyProcessor is changed to an incompatible version (MyProcessor 2.0), validation errors will be displayed on the processor:



- 'My Service' validated against '31c14fa6-015c-1000-6ba4-b7938e513e82' is invalid because Invalid Controller Service: 31c14fa6-015c-1000-6ba4-b7938e513e82 is not a valid Controller Service Identifier or does not reference the correct type of Controller Service
- 'My Service' validated against '31c14fa6-015c-1000-6ba4-b7938e513e82' is invalid because StandardMyService - 1.0 from org.apache.nifi - nifi-example-service-nar is not compatible with MyService - 2.0 from org.apache.nifi - nifi-example-service-api-nar

and an error message will be displayed in the processor's controller service configuration since the service is no longer valid:



Property	Value
My Property	Property1
My Service	Incompatible Controller Service Configured

Configuring a Processor

To configure a processor, right-click on the Processor and select the Configure option from the context menu. Alternatively, just double-click on the Processor. The configuration dialog is opened with four different tabs, each of which is discussed below. Once you have finished configuring the Processor, you can apply the changes by clicking "Apply" or cancel all changes by clicking "Cancel".

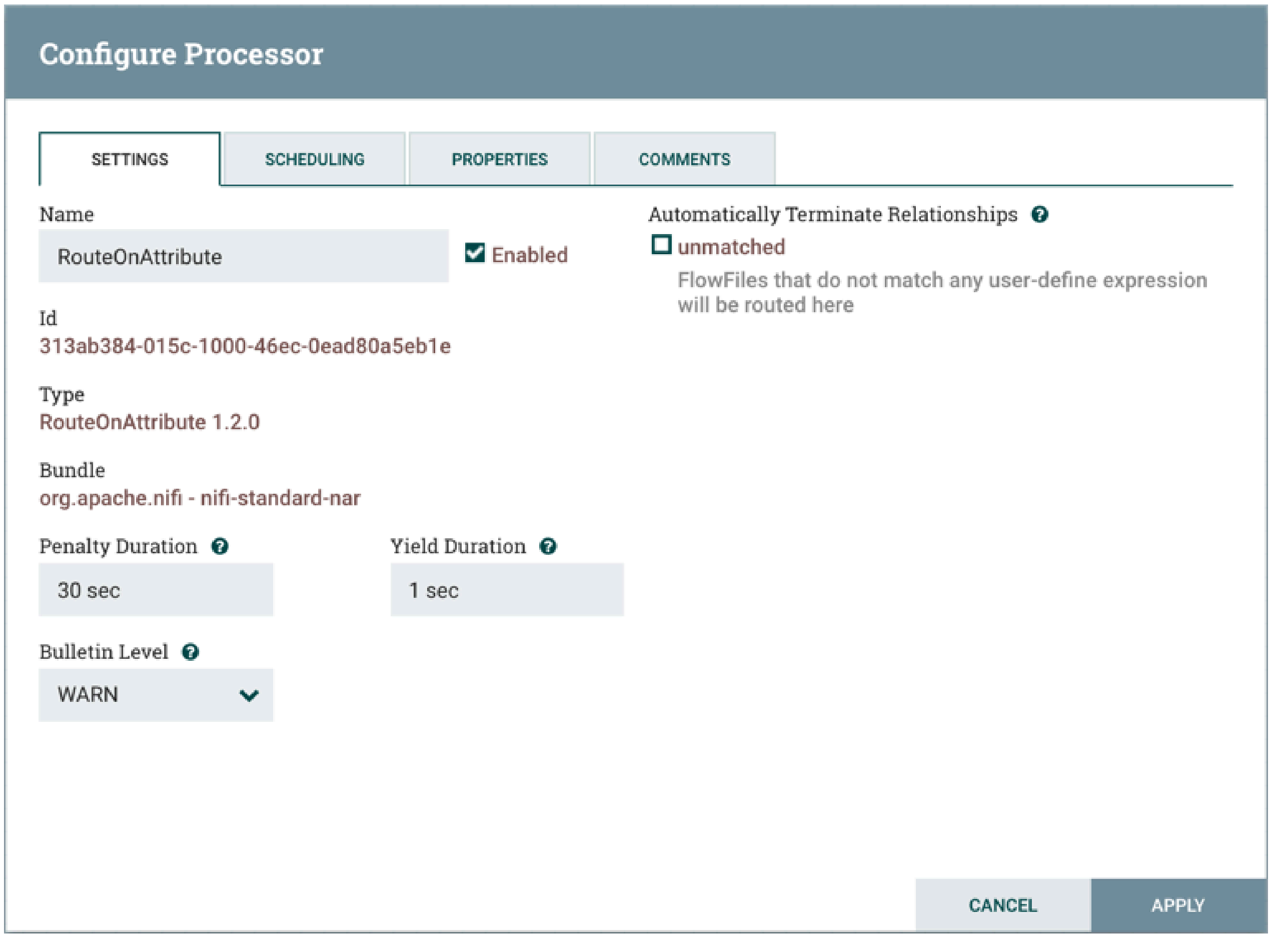
Note that after a Processor has been started, the context menu shown for the Processor no longer has a Configure option but rather has a View Configuration option. Processor configuration cannot be changed while the Processor is running. You must first stop the Processor and wait for all of its active tasks to complete before configuring the Processor again.

Note that entering certain control characters are not supported and will be automatically filtered out when entered. The following characters and any unpaired Unicode surrogate codepoints will not be retained in any configuration:

```
[#x0], [#x1], [#x2], [#x3], [#x4], [#x5], [#x6], [#x7], [#x8], [#xB], [#xC],
 [#xE], [#xF], [#x10], [#x11], [#x12], [#x13], [#x14], [#x15], [#x16], [#x1
7], [#x18], [#x19], [#x1A], [#x1B], [#x1C], [#x1D], [#x1E], [#x1F], [#xFFFE]
, [#xFFFF]
```

Settings Tab

The first tab in the Processor Configuration dialog is the Settings tab:



Name: RouteOnAttribute
☑ Enabled

Id: 313ab384-015c-1000-46ec-0ead80a5eb1e

Type: RouteOnAttribute 1.2.0

Bundle: org.apache.nifi - nifi-standard-nar

Penalty Duration: 30 sec

Yield Duration: 1 sec

Bulletin Level: WARN

Automatically Terminate Relationships
☐ unmatched
FlowFiles that do not match any user-define expression will be routed here

This tab contains several different configuration items. First, it allows the DFM to change the name of the Processor. The name of a Processor by default is the same as the Processor type. Next to the Processor Name is a checkbox, indicating whether the Processor is Enabled. When a Processor is added to the canvas, it is enabled. If the Processor is disabled, it cannot be started. The disabled state is used to indicate that when a group of Processors is started, such as when a DFM starts an entire Process Group, this (disabled) Processor should be excluded.

Below the Name configuration, the Processor's unique identifier is displayed along with the Processor's type and NAR bundle. These values cannot be modified.

Next are two dialogues for configuring 'Penalty Duration' and 'Yield Duration'. During the normal course of processing a piece of data (a FlowFile), an event may occur that indicates that the data cannot be processed at this time but the data may be processable at a later time. When this occurs, the Processor may choose to Penalize the FlowFile. This will prevent the FlowFile from being Processed for some period of time. For example, if the Processor is to push the data to a remote service, but the remote service already has a file with the same name as the filename that the Processor is specifying, the Processor may penalize the FlowFile. The 'Penalty Duration' allows the DFM to specify how long the FlowFile should be penalized. The default value is 30 seconds.

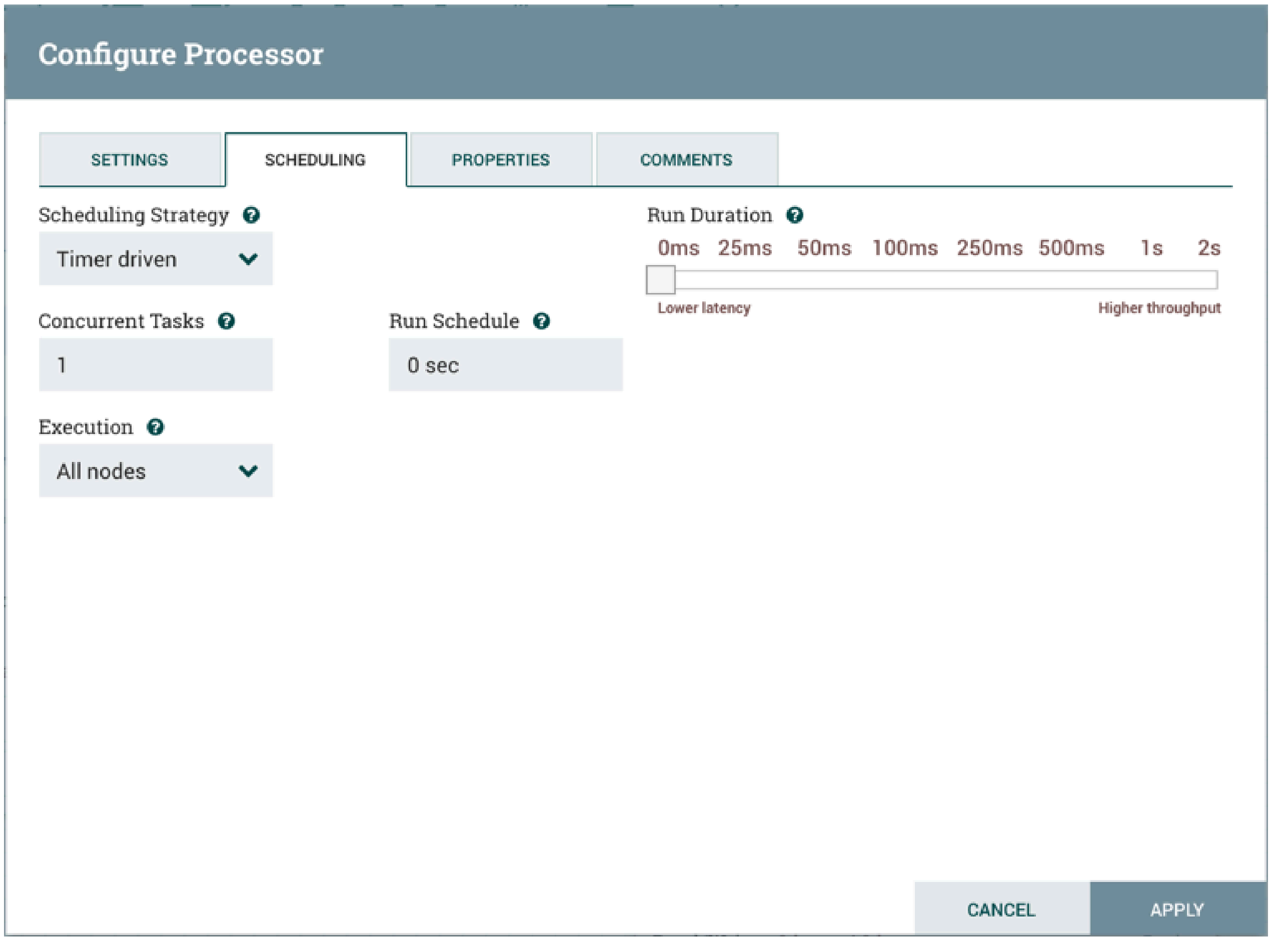
Similarly, the Processor may determine that some situation exists such that the Processor can no longer make any progress, regardless of the data that it is processing. For example, if a Processor is to push data to a remote service and that service is not responding, the Processor cannot make any progress. As a result, the Processor should 'yield', which will prevent the Processor from being scheduled to run for some period of time. That period of time is specified by setting the 'Yield Duration'. The default value is 1 second.

The last configurable option on the left-hand side of the Settings tab is the Bulletin level. Whenever the Processor writes to its log, the Processor also will generate a Bulletin. This setting indicates the lowest level of Bulletin that should be shown in the User Interface. By default, the Bulletin level is set to WARN, which means it will display all warning and error-level bulletins.

The right-hand side of the Settings tab contains an 'Automatically Terminate Relationships' section. Each of the Relationships that is defined by the Processor is listed here, along with its description. In order for a Processor to be considered valid and able to run, each Relationship defined by the Processor must be either connected to a downstream component or auto-terminated. If a Relationship is auto-terminated, any FlowFile that is routed to that Relationship will be removed from the flow and its processing considered complete. Any Relationship that is already connected to a downstream component cannot be auto-terminated. The Relationship must first be removed from any Connection that uses it. Additionally, for any Relationship that is selected to be auto-terminated, the auto-termination status will be cleared (turned off) if the Relationship is added to a Connection.

Scheduling Tab

The second tab in the Processor Configuration dialog is the Scheduling Tab:



Scheduling Strategy: Timer driven

Concurrent Tasks: 1

Run Schedule: 0 sec

Execution: All nodes

Run Duration: 0ms

Scheduling Strategy

The first configuration option is the Scheduling Strategy. There are three possible options for scheduling components:

Timer driven: This is the default mode. The Processor will be scheduled to run on a regular interval. The interval at which the Processor is run is defined by the 'Run Schedule' option (see below).

Event driven: When this mode is selected, the Processor will be triggered to run by an event, and that event occurs when FlowFiles enter Connections feeding this Processor. This mode is currently considered experimental and is not supported by all Processors. When this mode is selected, the 'Run Schedule' option is not configurable, as the Processor is not triggered to run periodically but as the result of an event. Additionally, this is the only mode for which the 'Concurrent Tasks' option can be set to 0. In this case, the number of threads is limited only by the size of the Event-Driven Thread Pool that the administrator has configured.

Note:

Experimental

This implementation is marked experimental as of Apache NiFi 1.10.0 (October 2019). The API, configuration, and internal behavior may change without warning, and such changes may occur during a minor release. Use at your own risk.

CRON driven: When using the CRON driven scheduling mode, the Processor is scheduled to run periodically, similar to the Timer driven scheduling mode. However, the CRON driven mode provides significantly more flexibility at the expense of increasing the complexity of the configuration. The CRON driven scheduling value is a string of six required fields and one optional field, each separated by a space. These fields are:

Field	Valid values
Seconds	0-59
Minutes	0-59
Hours	0-23
Day of Month	1-31
Month	1-12 or JAN-DEC
Day of Week	1-7 or SUN-SAT
Year (optional)	empty, 1970-2099

You typically specify values one of the following ways:

- Number: Specify one or more valid value. You can enter more than one value using a comma-separated list.
- Range: Specify a range using the <number>-<number> syntax.
- Increment: Specify an increment using <start value>/<increment> syntax. For example, in the Minutes field, 0/15 indicates the minutes 0, 15, 30, and 45.

You should also be aware of several valid special characters:

- * - Indicates that all values are valid for that field.
- ? - Indicates that no specific value is specified. This special character is valid in the Days of Month and Days of Week field.
- L - You can append L to one of the Day of Week values, to specify the last occurrence of this day in the month. For example, 1L indicates the last Sunday of the month.

For example:

- The string 0 0 13 * * ? indicates that you want to schedule the processor to run at 1:00 PM every day.
- The string 0 20 14 ? * MON-FRI indicates that you want to schedule the processor to run at 2:20 PM every Monday through Friday.
- The string 0 15 10 ? * 6L 2011-2017 indicates that you want to schedule the processor to run at 10:15 AM, on the last Friday of every month, between 2011 and 2017.

For additional information and examples, see the CronTrigger Tutorial in the Quartz Documentation.

Concurrent Tasks

Next, the Scheduling tab provides a configuration option named 'Concurrent Tasks'. This controls how many threads the Processor will use. Said a different way, this controls how many FlowFiles should be processed by this Processor at the same time. Increasing this value will typically allow the Processor to handle more data in the same amount of time. However, it does this by using system resources that then are not usable by other Processors. This essentially provides a relative weighting of Processors - it controls how much of the system's resources should be allocated to this

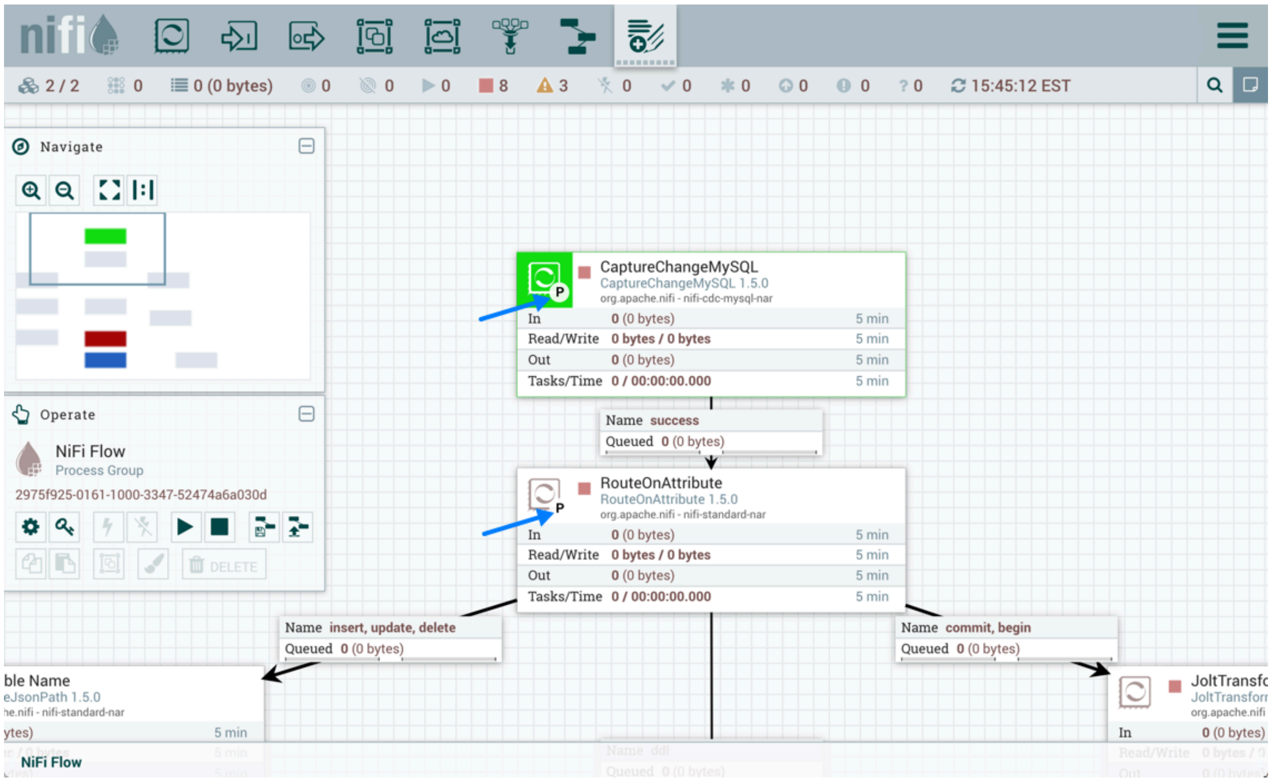
Processor instead of other Processors. This field is available for most Processors. There are, however, some types of Processors that can only be scheduled with a single Concurrent task.

Run Schedule

The 'Run Schedule' dictates how often the Processor should be scheduled to run. The valid values for this field depend on the selected Scheduling Strategy (see above). If using the Event driven Scheduling Strategy, this field is not available. When using the Timer driven Scheduling Strategy, this value is a time duration specified by a number followed by a time unit. For example, 1 second or 5 mins. The default value of 0 sec means that the Processor should run as often as possible as long as it has data to process. This is true for any time duration of 0, regardless of the time unit (i.e., 0 sec, 0 mins, 0 days). For an explanation of values that are applicable for the CRON driven Scheduling Strategy, see the description of the CRON driven Scheduling Strategy itself.

Execution

The Execution setting is used to determine on which node(s) the Processor will be scheduled to execute. Selecting 'All Nodes' will result in this Processor being scheduled on every node in the cluster. Selecting 'Primary Node' will result in this Processor being scheduled on the Primary Node only. Processors that have been configured for 'Primary Node' execution are identified by a "P" next to the processor icon:



CaptureChangeMySQL
CaptureChangeMySQL 1.5.0
org.apache.nifi - nifi-cdc-mysql-nar

In	0 (0 bytes)	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 (0 bytes)	5 min
Tasks/Time	0 / 00:00:00.000	5 min

Name success
Queued 0 (0 bytes)

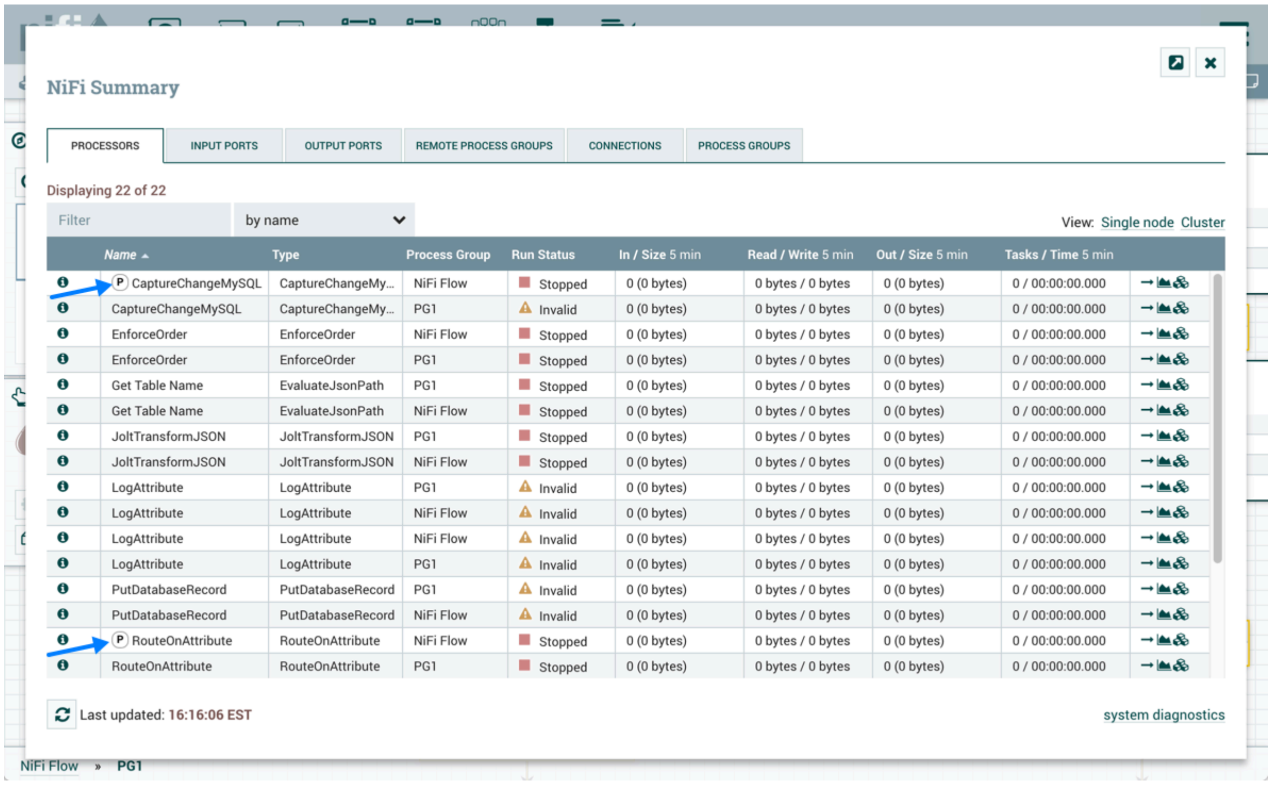
RouteOnAttribute
RouteOnAttribute 1.5.0
org.apache.nifi - nifi-standard-nar

In	0 (0 bytes)	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 (0 bytes)	5 min
Tasks/Time	0 / 00:00:00.000	5 min

Name insert, update, delete
Queued 0 (0 bytes)

Name commit, begin
Queued 0 (0 bytes)

To quickly identify 'Primary Node' processors, the "P" icon is also shown in the Processors tab on the Summary page:



NiFi Summary

PROCESSORS | INPUT PORTS | OUTPUT PORTS | REMOTE PROCESS GROUPS | CONNECTIONS | PROCESS GROUPS

Displaying 22 of 22

Filter | by name

View: Single node Cluster

Name ▲	Type	Process Group	Run Status	In / Size 5 min	Read / Write 5 min	Out / Size 5 min	Tasks / Time 5 min
Ⓟ CaptureChangeMySQL	CaptureChangeMy...	NiFi Flow	🟥 Stopped	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000
CaptureChangeMySQL	CaptureChangeMy...	PG1	⚠ Invalid	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000
EnforceOrder	EnforceOrder	NiFi Flow	🟥 Stopped	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000
EnforceOrder	EnforceOrder	PG1	🟥 Stopped	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000
Get Table Name	EvaluateJsonPath	PG1	🟥 Stopped	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000
Get Table Name	EvaluateJsonPath	NiFi Flow	🟥 Stopped	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000
JoltTransformJSON	JoltTransformJSON	PG1	🟥 Stopped	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000
JoltTransformJSON	JoltTransformJSON	NiFi Flow	🟥 Stopped	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000
LogAttribute	LogAttribute	PG1	⚠ Invalid	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000
LogAttribute	LogAttribute	NiFi Flow	⚠ Invalid	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000
LogAttribute	LogAttribute	NiFi Flow	⚠ Invalid	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000
LogAttribute	LogAttribute	PG1	⚠ Invalid	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000
PutDatabaseRecord	PutDatabaseRecord	PG1	⚠ Invalid	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000
PutDatabaseRecord	PutDatabaseRecord	NiFi Flow	⚠ Invalid	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000
Ⓟ RouteOnAttribute	RouteOnAttribute	NiFi Flow	🟥 Stopped	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000
RouteOnAttribute	RouteOnAttribute	PG1	🟥 Stopped	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000

Last updated: 16:16:06 EST

system diagnostics

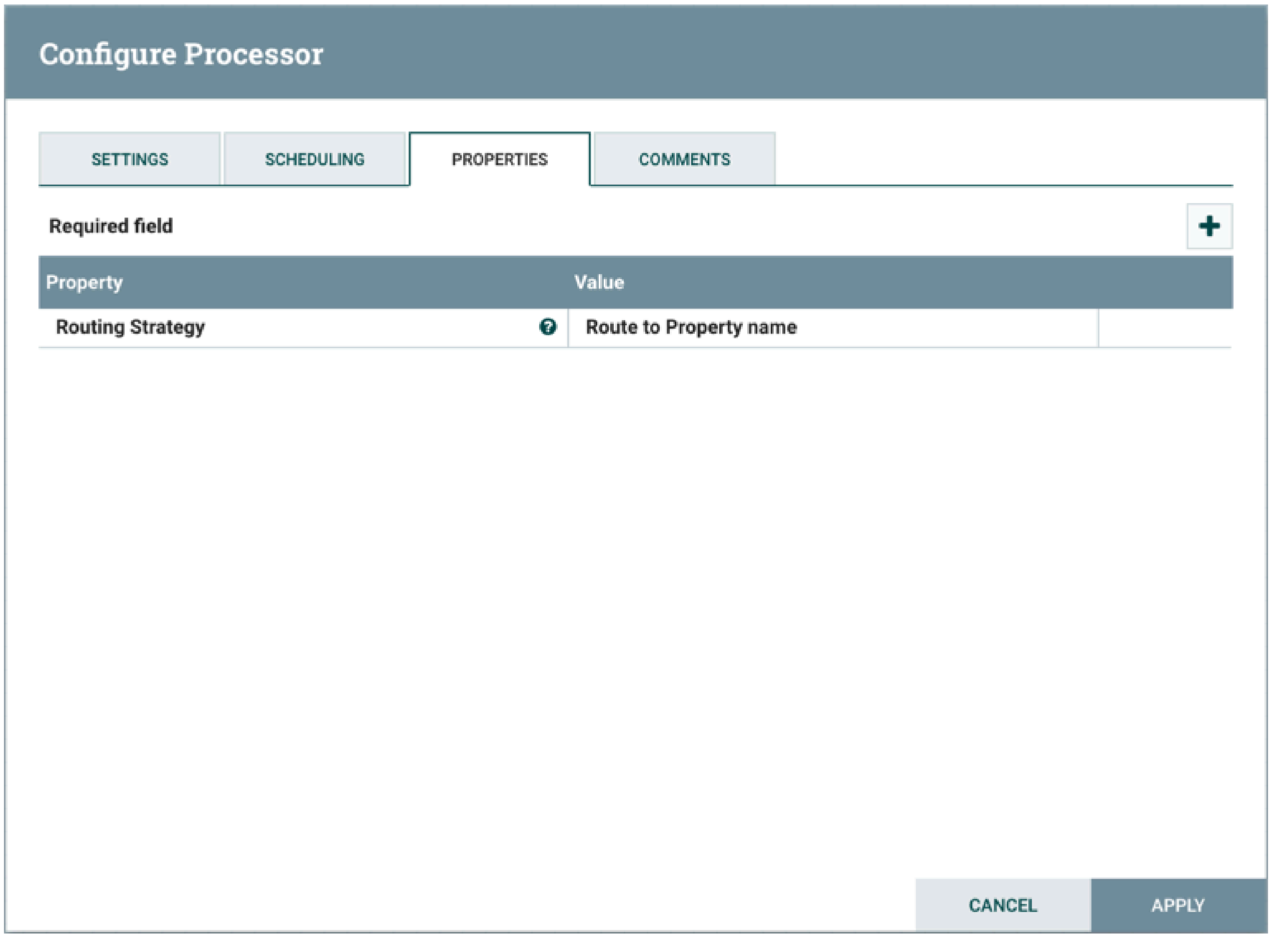
NiFi Flow » PG1

Run Duration

The right-hand side of the Scheduling tab contains a slider for choosing the 'Run Duration'. This controls how long the Processor should be scheduled to run each time that it is triggered. On the left-hand side of the slider, it is marked 'Lower latency' while the right-hand side is marked 'Higher throughput'. When a Processor finishes running, it must update the repository in order to transfer the FlowFiles to the next Connection. Updating the repository is expensive, so the more work that can be done at once before updating the repository, the more work the Processor can handle (Higher throughput). However, this means that the next Processor cannot start processing those FlowFiles until the previous Process updates this repository. As a result, the latency will be longer (the time required to process the FlowFile from beginning to end will be longer). As a result, the slider provides a spectrum from which the DFM can choose to favor Lower Latency or Higher Throughput.

Properties Tab

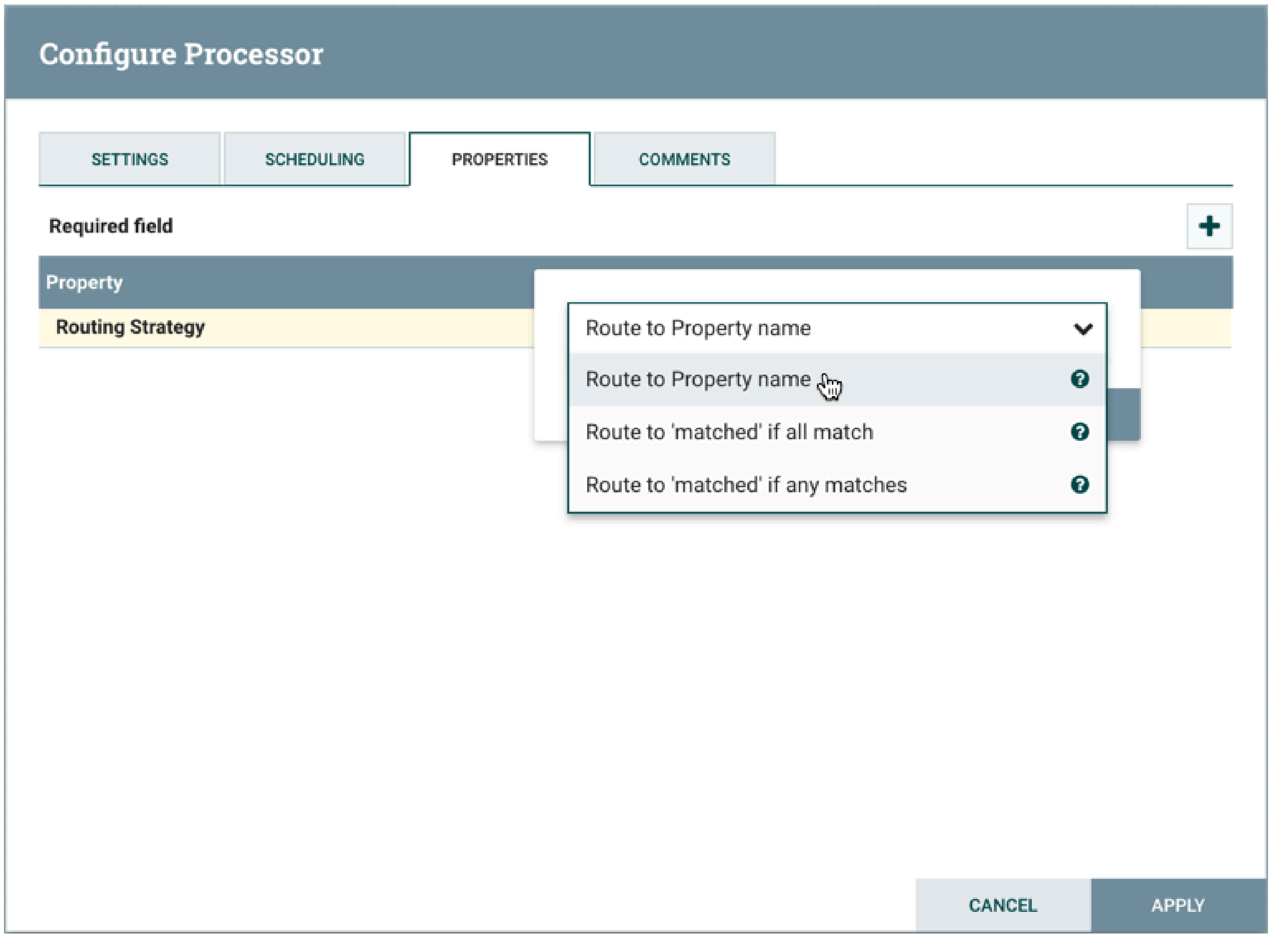
The Properties tab provides a mechanism to configure Processor-specific behavior. There are no default properties. Each type of Processor must define which Properties make sense for its use case. Below, we see the Properties tab for a RouteOnAttribute Processor:



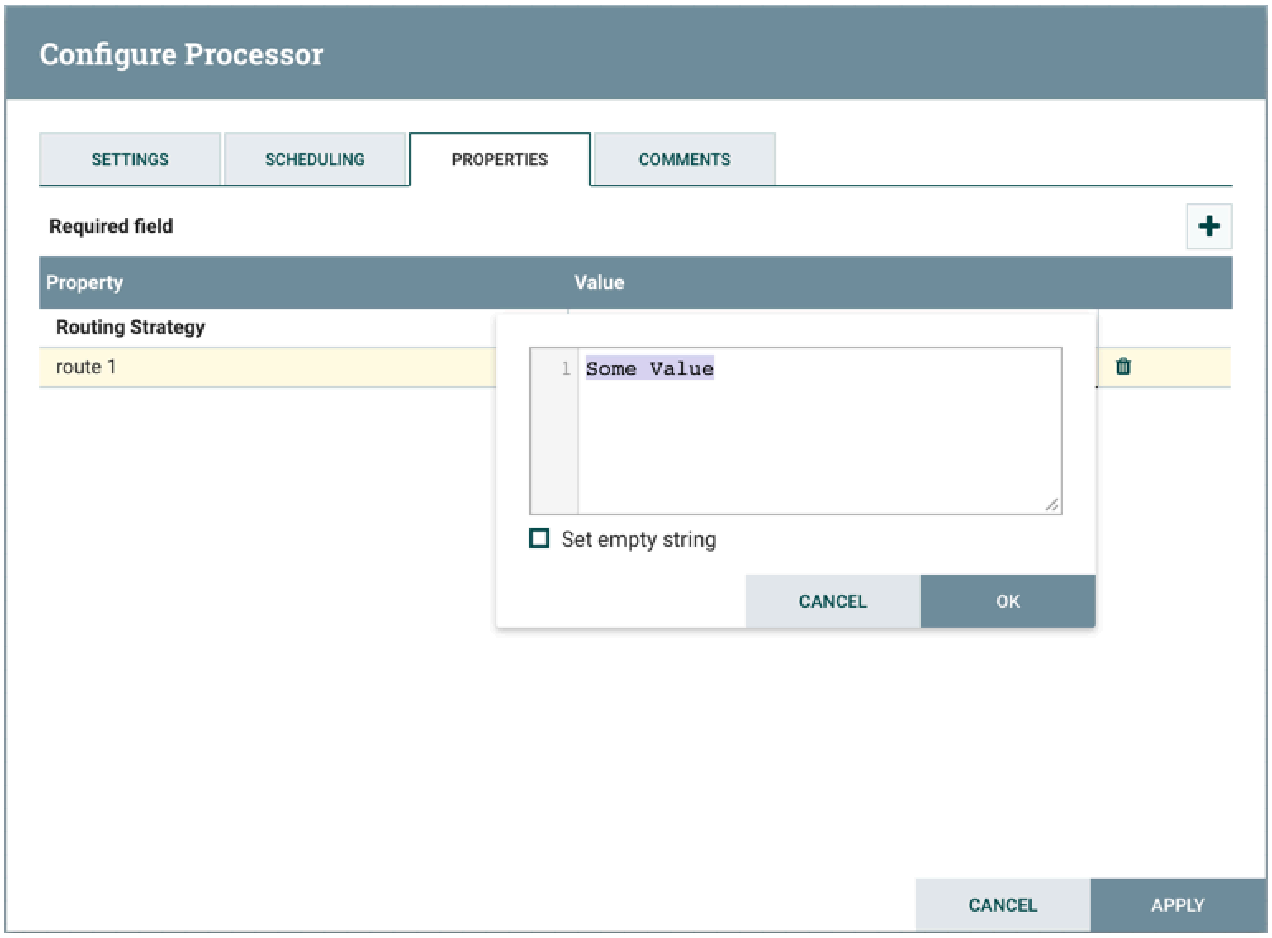
Property	Value
Routing Strategy	Route to Property name

This Processor, by default, has only a single property: 'Routing Strategy'. The default value is 'Route to Property name'. Next to the name of this property is a small question mark symbol (?). This help symbol is seen in other places throughout the User Interface, and it indicates that more information is available. Hovering over this symbol with the mouse will provide additional details about the property and the default value, as well as historical values that have been set for the Property.

Clicking on the value for the property will allow a DFM to change the value. Depending on the values that are allowed for the property, the user is either provided a drop-down from which to choose a value or is given a text area to type a value:



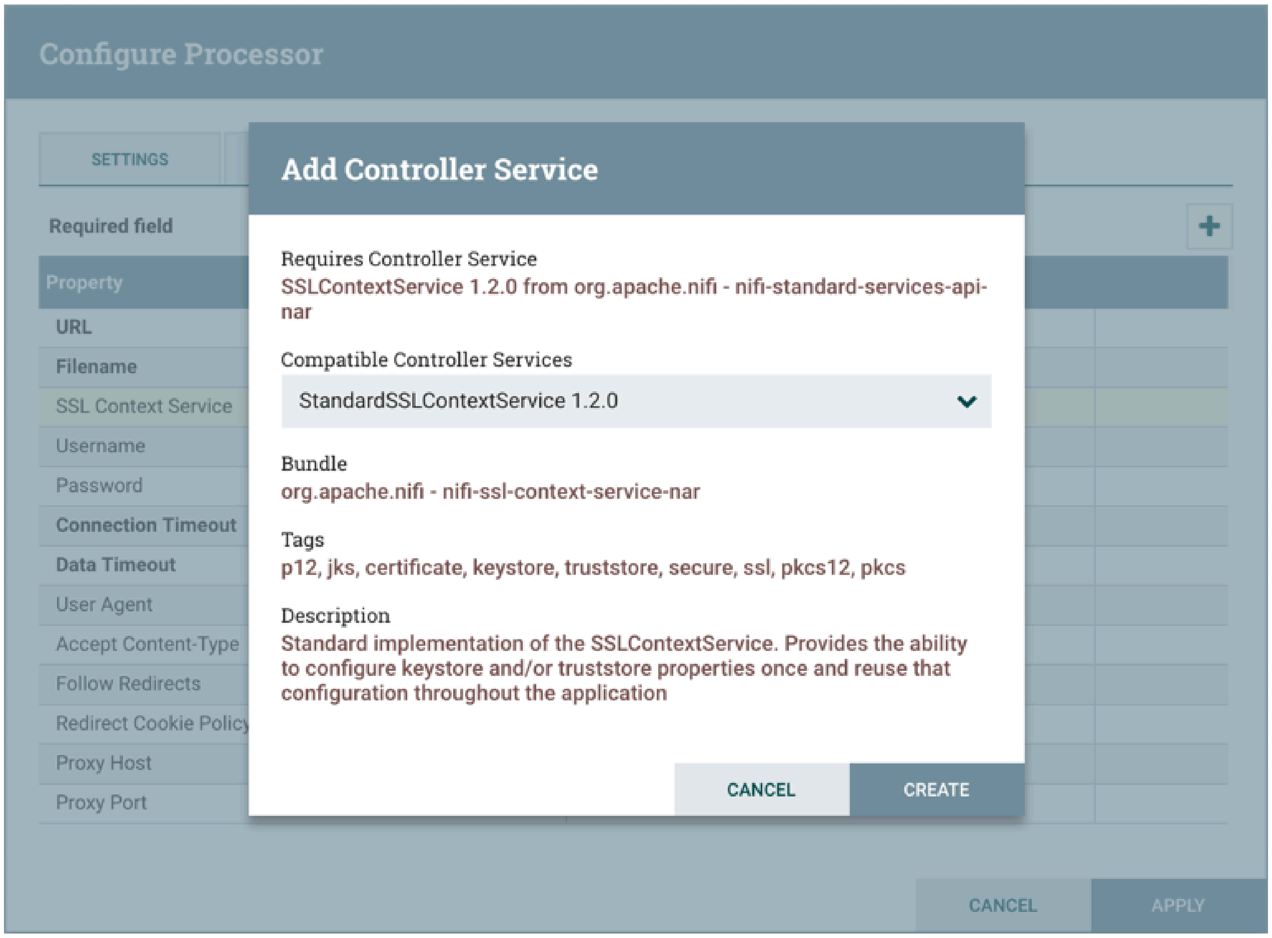
In the top-right corner of the tab is a button for adding a New Property. Clicking this button will provide the DFM with a dialog to enter the name and value of a new property. Not all Processors allow User-Defined properties. In processors that do not allow them, the Processor becomes invalid when User-Defined properties are applied. RouteOnAttribute, however, does allow User-Defined properties. In fact, this Processor will not be valid until the user has added a property.



Note that after a User-Defined property has been added, an icon will appear on the right-hand side of that row ( ). Clicking it will remove the User-Defined property from the Processor.

Some processors also have an Advanced User Interface (UI) built into them. For example, the UpdateAttribute processor has an Advanced UI. To access the Advanced UI, click the "Advanced" button that appears at the bottom of the Configure Processor window. Only processors that have an Advanced UI will have this button.

Some processors have properties that refer to other components, such as Controller Services, which also need to be configured. For example, the GetHTTP processor has an SSLContextService property, which refers to the StandardSSLContextService controller service. When DFMs want to configure this property but have not yet created and configured the controller service, they have the option to create the service on the spot, as depicted in the image below. For more information about configuring Controller Services, see the Controller Services section.



Requires Controller Service
SSLContextService 1.2.0 from org.apache.nifi - nifi-standard-services-api-nar

Compatible Controller Services
StandardSSLContextService 1.2.0

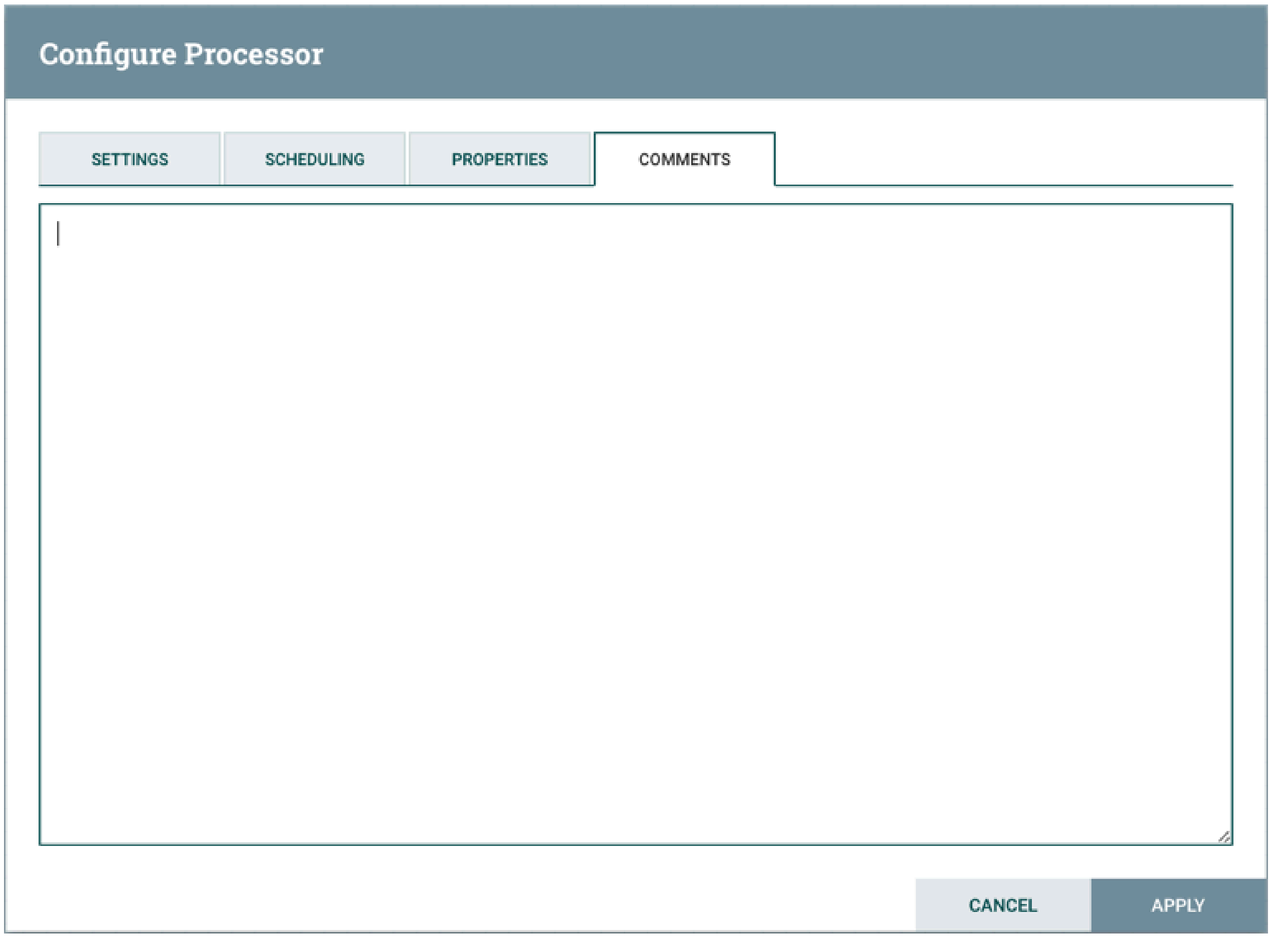
Bundle
org.apache.nifi - nifi-ssl-context-service-nar

Tags
p12, jks, certificate, keystore, truststore, secure, ssl, pkcs12, pkcs

Description
Standard implementation of the SSLContextService. Provides the ability to configure keystore and/or truststore properties once and reuse that configuration throughout the application

Comments Tab

The last tab in the Processor configuration dialog is the Comments tab. This tab simply provides an area for users to include whatever comments are appropriate for this component. Use of the Comments tab is optional:



Additional Help

You can access additional documentation about each Processor's usage by right-clicking on the Processor and selecting 'Usage' from the context menu. Alternatively, select Help from the Global Menu in the top-right corner of the UI to display a Help page with all of the documentation, including usage documentation for all the Processors that are available. Click on the desired Processor to view usage documentation.

Configuring a Process Group

To configure a Process Group, right-click on the Process Group and select the Configure option from the context menu. The configuration dialog is opened with two tabs: General and Controller Services.

General Tab

This tab contains several different configuration items. First is the Process Group Name. This is the name that is shown at the top of the Process Group on the canvas as well as in the breadcrumbs at the bottom of the UI. For the Root Process Group (i.e., the highest level group), this is also the name that is shown as the title of the browser tab. Note that this information is visible to any other NiFi instance that connects remotely to this instance (using Remote Process Groups, a.k.a., Site-to-Site).

The next configuration element is the Process Group Parameter Context, which is used to provide parameters to components of the flow. From this drop-down, the user is able to choose which Parameter Context should be bound to this Process Group and can optionally create a new one to bind to the Process Group. For more information refer to Parameters and Parameter Contexts..

The third element in the configuration dialog is the Process Group Comments. This provides a mechanism for providing any useful information or context about the Process Group.

The last two elements, Process Group FlowFile Currency and Process Group Outbound Policy, are covered in the following sections.

FlowFile Concurrency

FlowFile Concurrency is used to control how data is brought into the Process Group. There are three options available:

- Unbounded (the default)
- Single FlowFile Per Node
- Single Batch Per Node

When the FlowFile Concurrency is set to "Unbounded", the Input Ports in the Process Group will ingest data as quickly as they are able, provided that backpressure does not prevent them from doing so.

When the FlowFile Concurrency is configured to "Single FlowFile Per Node", the Input Ports will only allow a single FlowFile through at at time. Once that FlowFile enters the Process Group, no additional FlowFiles will be brought in until all FlowFiles have left the Process Group (either by being removed from the system/auto-terminated, or by exiting through an Output Port). This will often result in slower performance, as it reduces the parallelization that NiFi uses to process the data. However, there are several reasons that a user may want to use this approach. A common use case is one in which each incoming FlowFile contains references to several other data items, such as a list of files in a directory. The user may want to process the entire listing before allowing any other data to enter the Process Group.

When the FlowFile Concurrency is configured to "Single Batch Per Node", the Input Ports will behave similarly to the way that they behave in the "Single FlowFile Per Node" mode, but when a FlowFile is ingested, the Input Ports will continue to ingest all data until all of the queues feeding the Input Ports have been emptied. At that point, they will not bring any more data into the Process Group until all data has finished processing and has left the Process Group (see e2735a06acb61724bba6d0173c2fc47c2bec3692.xml#Connecting_Batch_Oriented_Groups).

Note: The FlowFile Concurrency controls only when data will be pulled into the Process Group from an Input Port. It does not prevent a Processor within the Process Group from ingesting data from outside of NiFi.

Outbound Policy

While the FlowFile Concurrency dictates how data should be brought into the Process Group, the Outbound Policy controls the flow of data out of the Process Group. There are two available options available:

- Stream When Available (the default)
- Batch Output

When the Outbound Policy is configured to "Stream When Available", data that arrives at an Output Port is immediately transferred out of the Process Group, assuming that no backpressure is applied.

When the Outbound Policy is configured to "Batch Output", the Output Ports will not transfer data out of the Process Group until all data that is in the Process Group is queued up at an Output Port (i.e., no data leaves the Process Group until all of the data has finished processing). It doesn't matter whether the data is all queued up for the same Output Port, or if some data is queued up for Output Port A while other data is queued up for Output Port B. These conditions are both considered the same in terms of the completion of the FlowFile Processing.

Using an Outbound Policy of "Batch Output" along with a FlowFile Concurrency of "Single FlowFile Per Node" allows a user to easily ingest a single FlowFile (which in and of itself may represent a batch of data) and then wait until all processing of that FlowFile has completed before continuing on to the next step in the dataflow (i.e., the next component outside of the Process Group). Additionally, when using this mode, each FlowFile that is transferred out of the Process Group will be given a series of attributes named "batch.output.<Port Name>" for each Output Port in the Process Group. The value will be equal to the number of FlowFiles that were routed to that Output Port for this batch of data. For example, consider a case where a single FlowFile is split into 5 FlowFiles, and two FlowFiles go to Output Port A, one goes to Output Port B, and two go to Output Port C, and no FlowFiles go to Output Port D. In this case, each FlowFile will have attributes batch.output.A = 2, batch.output.B = 1, batch.output.C = 2, batch.output.D = 0.

The Outbound Policy of "Batch Output" doesn't provide any benefits when used in conjunction with a FlowFile Concurrency of "Unbounded". As a result, the Outbound Policy is ignored if the FlowFile Concurrency is set to "Unbounded".

Connecting Batch-Oriented Process Groups

A common use case in NiFi is to perform some batch-oriented process and only after that process completes perform another process on that same batch of data.

NiFi makes this possible by encapsulating each of these processes in its own Process Group. The Outbound Policy of the first Process Group should be configured as "Batch Output" while the FlowFile Concurrency should be either "Single FlowFile Per Node" or "Single Batch Per Node". With this configuration, the first Process Group will process an entire batch of data (which will either be a single FlowFile or many FlowFiles depending on the FlowFile Concurrency) as a coherent batch of data. When processing has completed for that batch of data, the data will be held until all FlowFiles are finished processing and ready to leave the Process Group. At that point, the data can be transferred out of the Process Group as a batch. This configuration - when a Process Group is configured with an Outbound Policy of "Batch Output" and an Output Port is connected directly to the Input Port of a Process Group with a FlowFile Concurrency of "Single Batch Per Node" - is treated as a slightly special case. The receiving Process Group will ingest data not only until its input queues are empty but until they are empty AND the source Process Group has transferred all of the data from that batch out of the Process Group. This allows a collection of FlowFiles to be transferred as a single batch of data between Process Groups - even if those FlowFiles are spread across multiple ports.

Caveats

When using a FlowFile Concurrency of "Single FlowFile Per Node", there are a couple of caveats to consider.

First, an Input Port is free to bring data into the Process Group if there is no data queued up in that Process Group on the same node. This means that in a 5-node cluster, for example, there may be up to 5 incoming FlowFiles being processed simultaneously. Additionally, if a connection is configured to use Load Balancing, it may transfer data to another node in the cluster, allowing data to enter the Process Group while that FlowFile is still being processed. As a result, it is not recommended to use Load-Balanced Connections within a Process Group that is not configured for "Unbounded" FlowFile Concurrency.

When using the Outbound Policy of "Batch Output", it is important to consider backpressure. Consider a case where no data will be transferred out of a Process Group until all data is finished processing. Also consider that the connection to Output Port A has a backpressure threshold of 10,000 FlowFiles (the default). If that queue reaches the threshold of 10,000, the upstream Processor will no longer be triggered. As a result, data will not finish processing, and the flow will end in a deadlock, as the Output Port will not run until the processing completes and the Processor will not run until the Output Port runs. To avoid this, if a large number of FlowFiles are expected to be generated from a single input FlowFile, it is recommended that backpressure for Connections ending in an Output Port be configured in such a way to allow for the largest expected number of FlowFiles or backpressure for those Connections be disabled all together (by setting the Backpressure Threshold to 0). See Back Pressure for more information.

Controller Services

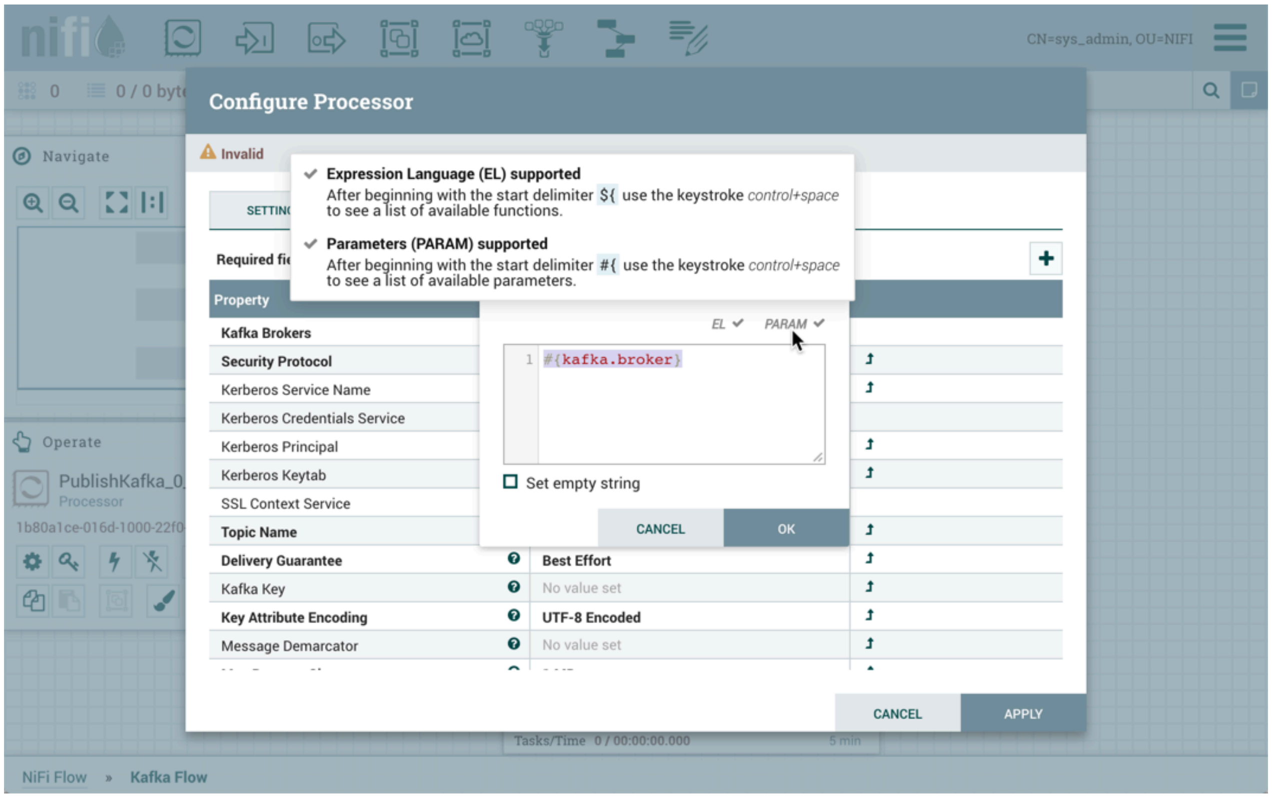
The Controller Services tab in the Process Group configuration dialog is covered in Adding Controller Services for Dataflows.

Parameters

The values of properties in the flow, including sensitive properties, can be parameterized using Parameters. Parameters are created and configured within the NiFi UI. Any property can be configured to reference a Parameter with the following conditions:

- A sensitive property can only reference a Sensitive Parameter
- A non-sensitive property can only reference a Non-Sensitive Parameter
- Properties that reference Controller Services can not use Parameters
- Parameters cannot be referenced in Reporting Tasks or in controller-level Controller Services

The UI indicates whether a Parameter can be used for a property value.



✓ **Expression Language (EL) supported**
After beginning with the start delimiter `${` use the keystroke *control+space* to see a list of available functions.

✓ **Parameters (PARAM) supported**
After beginning with the start delimiter `#{` use the keystroke *control+space* to see a list of available parameters.

```
#{kafka.broker}
```

☐ Set empty string

Property	
Kafka Brokers	
Security Protocol	
Kerberos Service Name	
Kerberos Credentials Service	
Kerberos Principal	
Kerberos Keytab	
SSL Context Service	
Topic Name	
Delivery Guarantee	Best Effort
Kafka Key	No value set
Key Attribute Encoding	UTF-8 Encoded
Message Demarcator	No value set

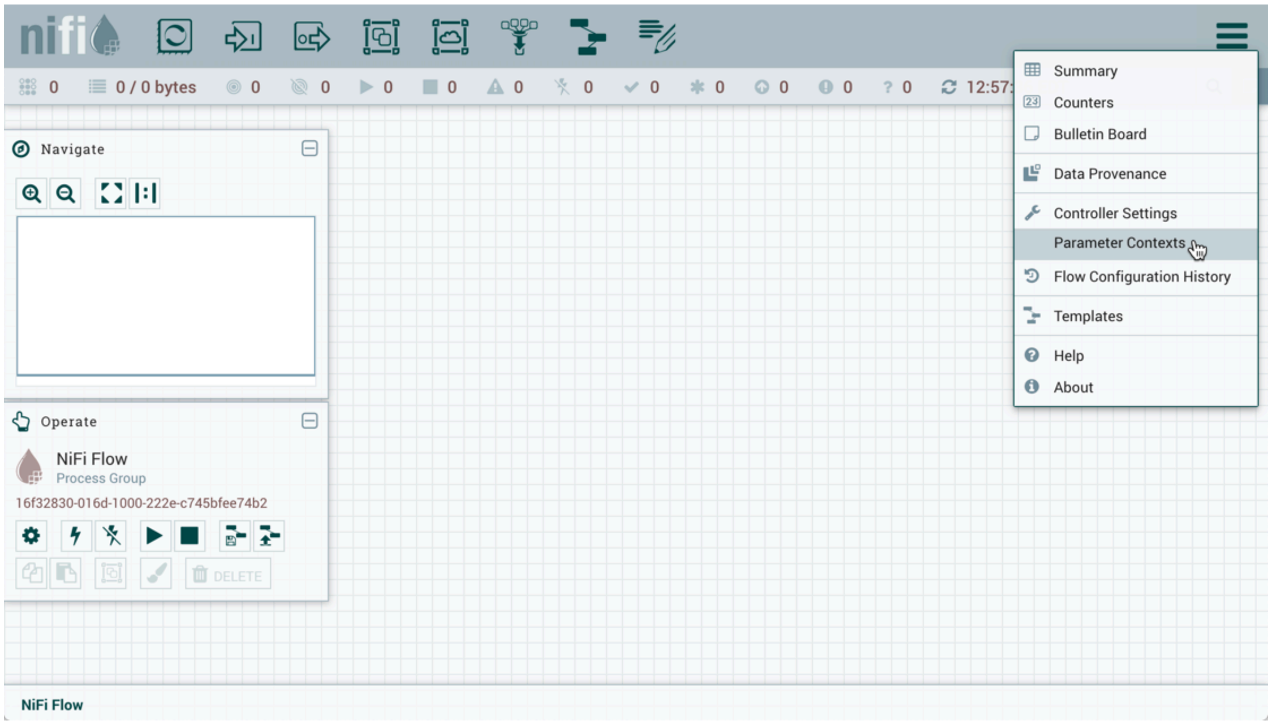
Note: Parameters have numerous advantages over Variables. In addition to sensitive value support, Parameters offer more granular control over access policies. Additionally, properties that reference Parameters are validated against the substituted value, unlike most properties that reference Variables using Expression Language.

Parameter Contexts

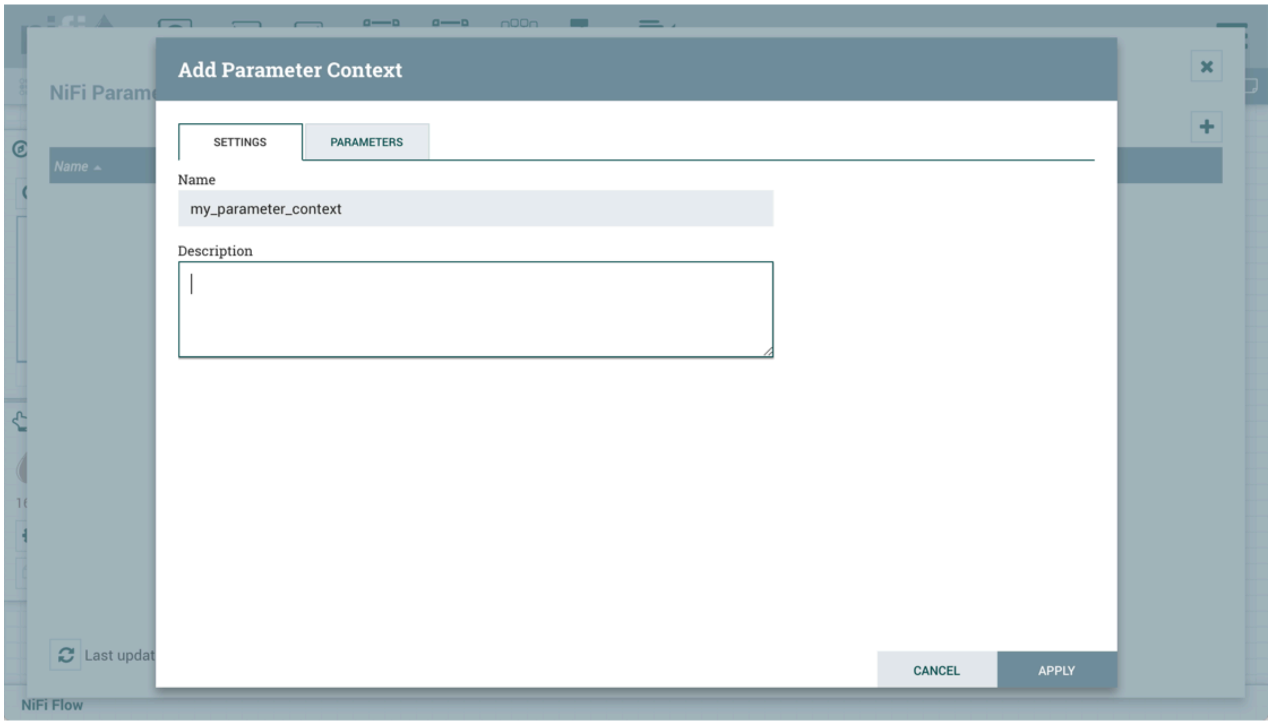
Parameters are created within Parameter Contexts. Parameter Contexts are globally defined/accessible to the NiFi instance. Access policies can be applied to Parameter Contexts to determine which users can create them. Once created, policies to read and write to a specific Parameter Context can also be applied (see Accessing Parameters for more information).

Creating a Parameter Context

To create a Parameter Context, select Parameter Contexts from the Global Menu:



In the Parameter Contexts window, click the + button in the upper-right corner and the Add Parameter Context window opens. The window has two tabs: Settings and Parameters.



Name: my_parameter_context

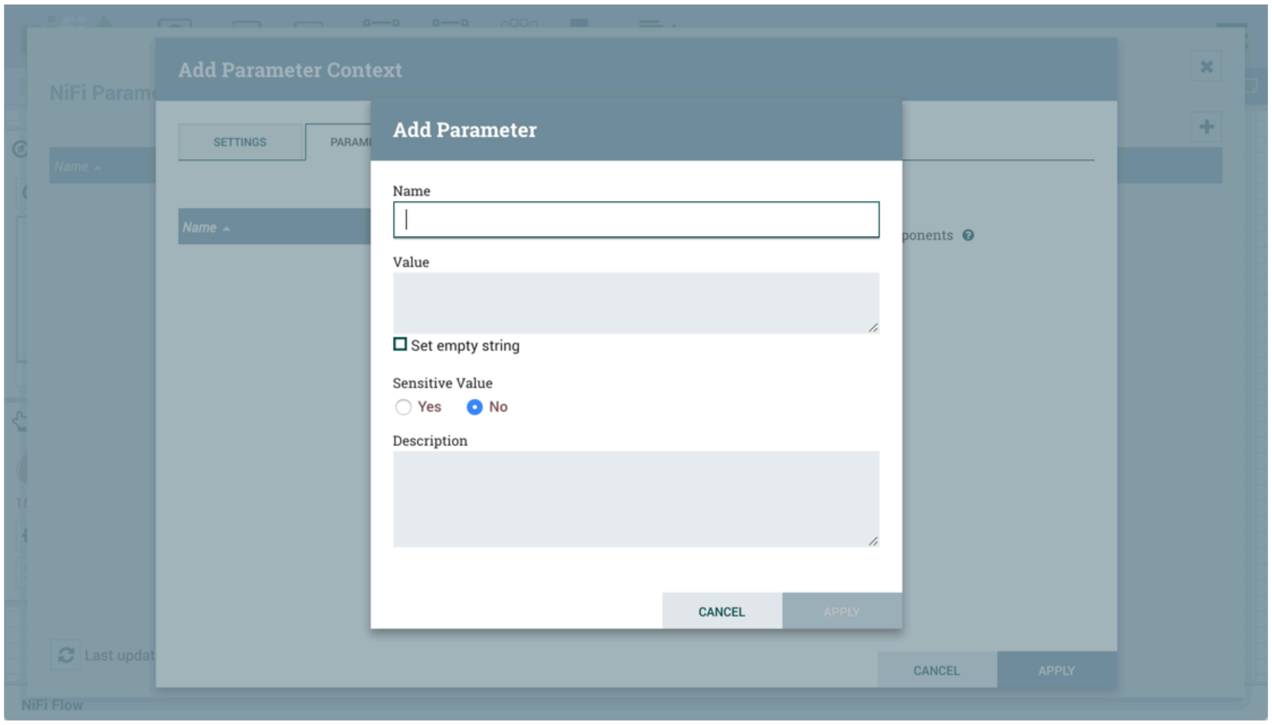
Description:

On the "Settings" tab, add a name for the Parameter Context and a description if desired. Select "Apply" to save the Parameter Context or select the "Parameters" tab to add parameters to the context.

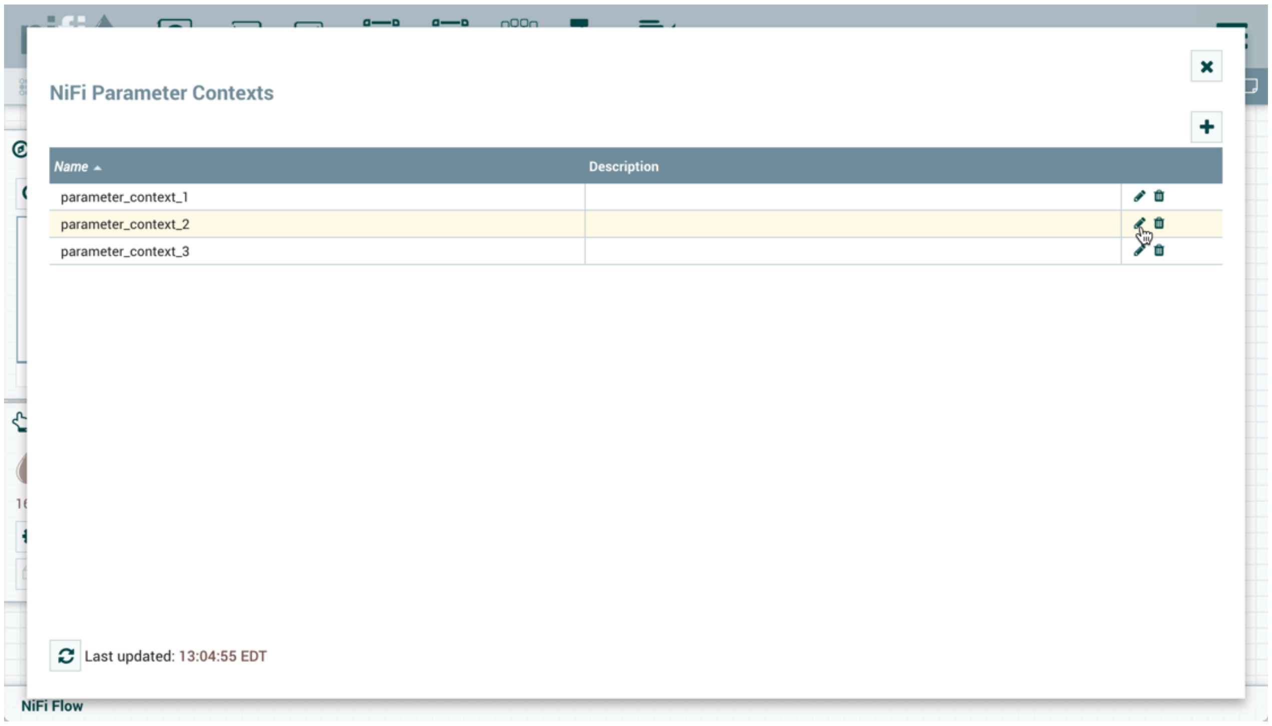
Adding a Parameter to a Parameter Context

Parameters can be added during Parameter Context creation or added to existing Parameter Contexts.

During Parameter Context creation, select the "Parameters" tab. Click the + button to open the Add Parameter window.



To add parameters to an existing Parameter Context, open the Parameter Context window and click the Edit button ( ) in the row of the desired Parameter Context.


NiFi Parameter Contexts

Name	Description
parameter_context_1	
parameter_context_2	
parameter_context_3	

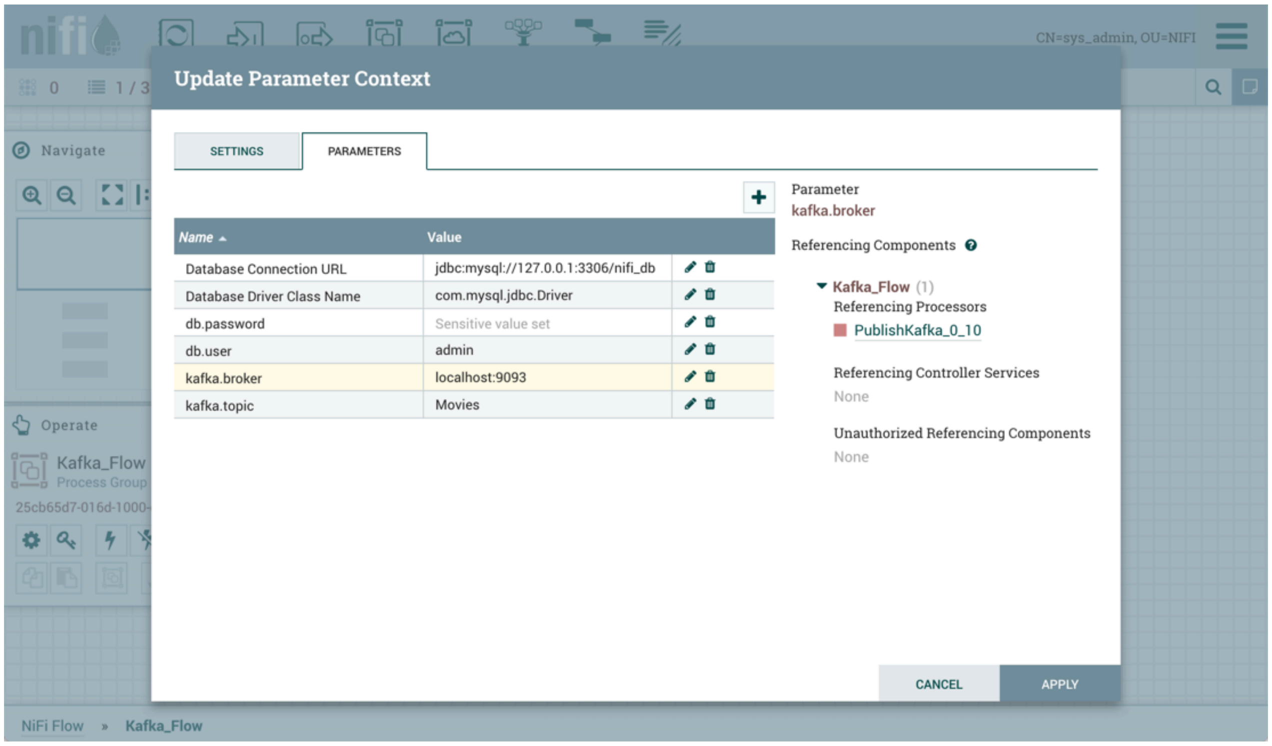
Last updated: 13:04:55 EDT

On the "Parameters" tab, click the + button to open the Add Parameter window.

The Add Parameter window has the following settings:

- Name - A name that is used to denote the Parameter. Only alpha-numeric characters (a-z, A-Z, 0-9), hyphens (-), underscores (_), periods (.), and spaces are allowed.
- Value - The value that will be used when the Parameter is referenced. If a Parameter makes use of the Expression Language, it is important to note that the Expression Language will be evaluated in the context of the component that references the Parameter. Please see the Parameters and Expression Language section below for more information.
- Set empty string - Check to explicitly set the value of the Parameter to an empty string. Unchecked by default. (Note: If checked but a value is set, the checkbox is ignored.)
- Sensitive Value - Set to "Yes" if the Parameter's Value should be considered sensitive. If sensitive, the value of the Parameter will not be shown in the UI once applied. The default setting is "No". Sensitive Parameters can only be referenced by sensitive properties and Non-Sensitive Parameters by non-sensitive properties. Once a Parameter is created, its sensitivity flag cannot be changed.
- Description - A description that explains what the Parameter is, how it is to be used, etc. This field is optional.

Once these settings are configured, select "Apply". The Referencing Components lists the components referenced by the currently selected parameter. Add additional Parameters or edit any existing Parameters.



Name	Value
Database Connection URL	jdbc:mysql://127.0.0.1:3306/nifi_db
Database Driver Class Name	com.mysql.jdbc.Driver
db.password	Sensitive value set
db.user	admin
kafka.broker	localhost:9093
kafka.topic	Movies

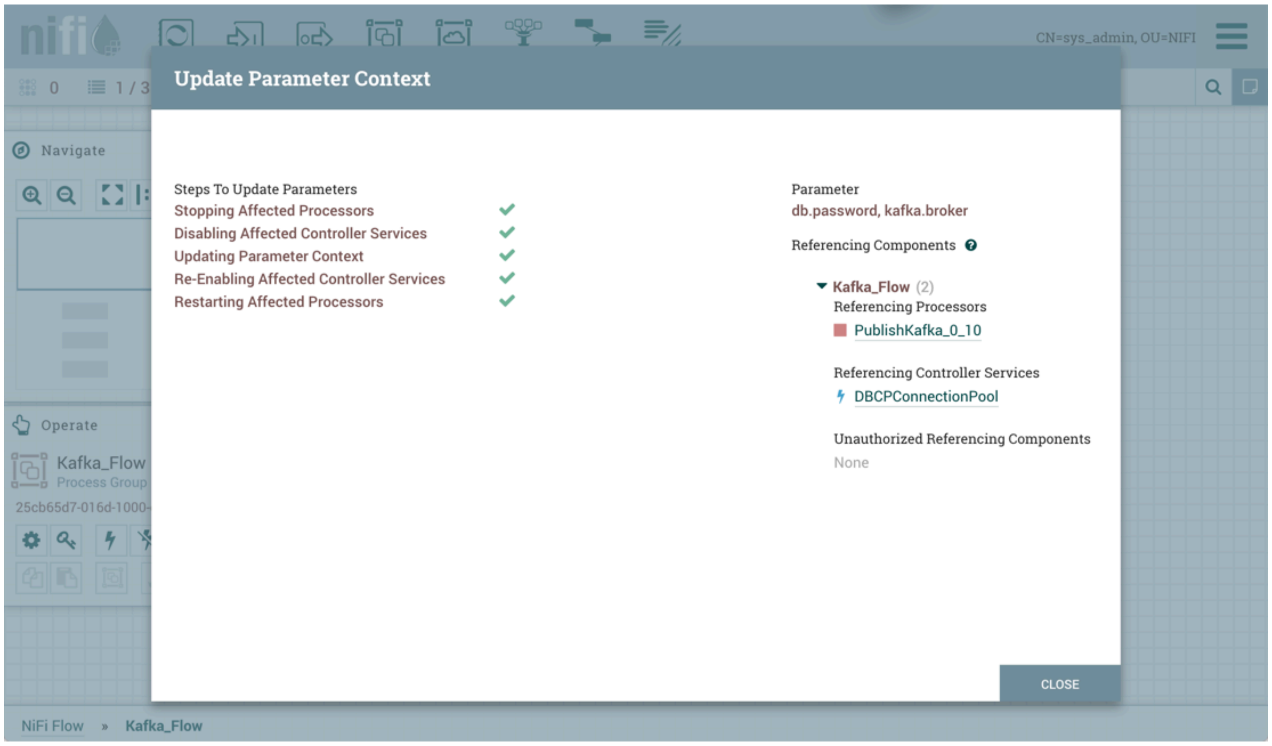
Parameter
kafka.broker

Referencing Components
Kafka_Flow (1)
Referencing Processors
PublishKafka_0_10

Referencing Controller Services
None

Unauthorized Referencing Components
None

To complete the process, select "Apply" from the Parameter Context window. The following operations are performed to validate all components that reference the added or modified parameters: Stopping/Restarting affected Processors, Disabling/Re-enabling affected Controller Services, Updating Parameter Context.


Update Parameter Context

Steps To Update Parameters
Stopping Affected Processors ✓
Disabling Affected Controller Services ✓
Updating Parameter Context ✓
Re-Enabling Affected Controller Services ✓
Restarting Affected Processors ✓

Parameter
db.password, kafka.broker

Referencing Components

Kafka_Flow (2)
Referencing Processors
PublishKafka_0_10

Referencing Controller Services
DBCPConnectionPool

Unauthorized Referencing Components
None

The Referencing Components section now lists an aggregation of all the components referenced by the set of parameters added/edited/deleted, organized by process group.

Parameters and Expression Language

When adding a Parameter that makes use of the Expression Language, it is important to understand the context in which the Expression Language will be evaluated. The expression is always evaluated in the context of the Process or Controller Service that references the Parameter. Take, for example, a scenario where Parameter with the name Time is added with a value of ${now()}. The Expression Language results in a call to determine the system time when it is evaluated. When added as a Parameter, the system time is not evaluated when the Parameter is added, but rather when a Processor or Controller Service evaluates the Expression. That is, if a Processor has a Property whose value is set to #{Time} it will function in exactly the same manner as if the Property's value were set to ${now()}. Each time that the property is referenced, it will produce a different timestamp.

Furthermore, some Properties do not allow for Expression Language, while others allow for Expression Language but do not evaluate expressions against FlowFile attributes. To help understand how this works, consider a Parameter named File whose value is ${filename}. Then consider three different properties, each with a different Expression Language Scope and a FlowFile whose filename is test.txt. If each of those Properties is set to #{File}, then the follow table illustrates the resultant value.

Configured Property Value	Expression Language Scope	Effective Property Value	Notes
#{File}	FlowFile Attributes	test.txt	The filename is resolved by looking at the filename attribute.
#{File}	Variable Registry Only	Empty String	FlowFile attributes are not in scope, and we assume there is no Variable in the Variable Registry named "filename"
#{File}	None	${filename}	The literal text "${filename}" will be unevaluated.

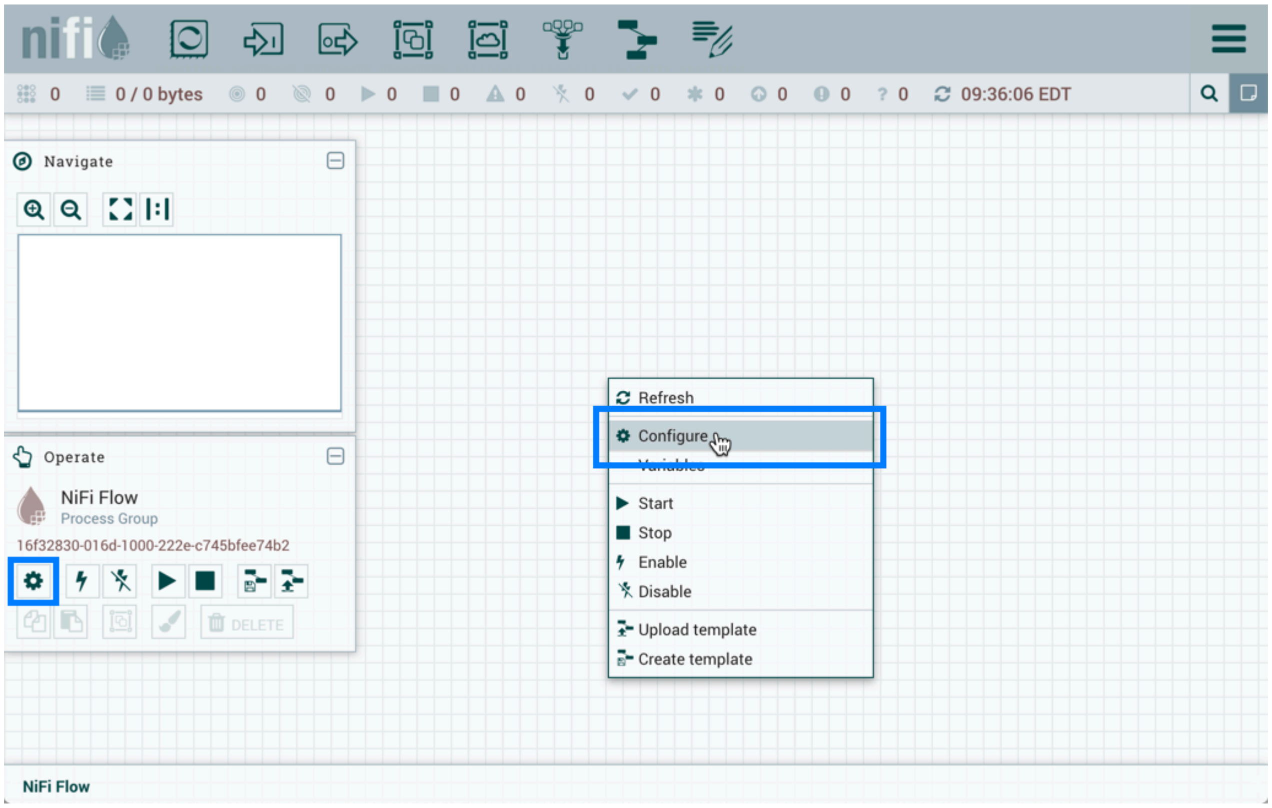
Assigning a Parameter Context to a Process Group

For a component to reference a Parameter, its Process Group must first be assigned a Parameter Context. Once assigned, processors and controller services within that Process Group may only reference Parameters within that Parameter Context.

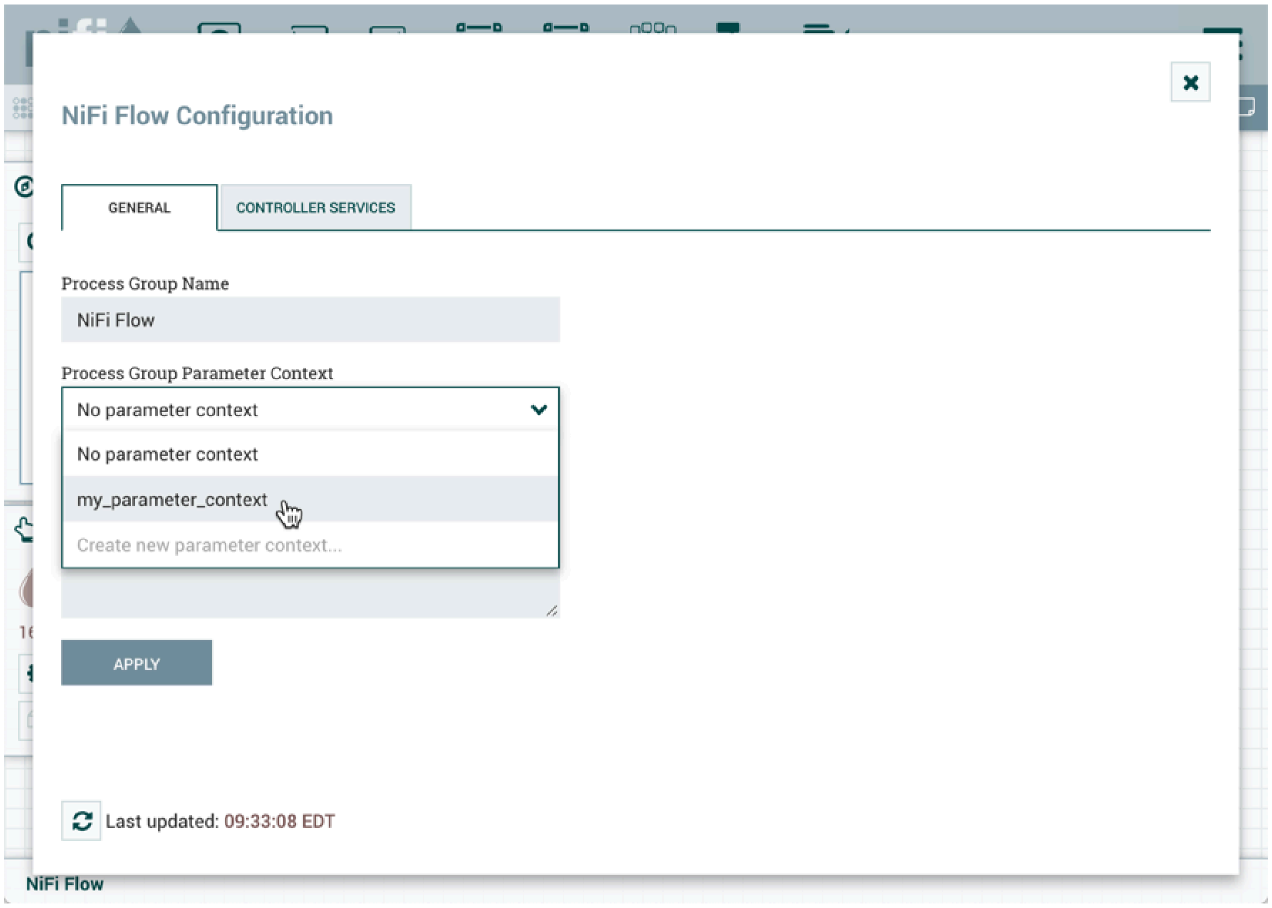
A Process Group can only be assigned one Parameter Context, while a given Parameter Context can be assigned to multiple Process Groups.

Note: A user can only set the Parameter Context of a Process Group to one of the Parameter Contexts that the user has the view policy for. Additionally, in order to set the Parameter Context, the user must have the modify policy for the Process Group. See Accessing Parameters for more information.

To assign a Parameter Context to a Process Group, click Configure, either from the Operate Palette or from the Process Group context menu.



In the Flow Configuration window, select the "General" tab. From the Process Group Parameter Context drop-down menu, select an existing Parameter Context or create a new one.



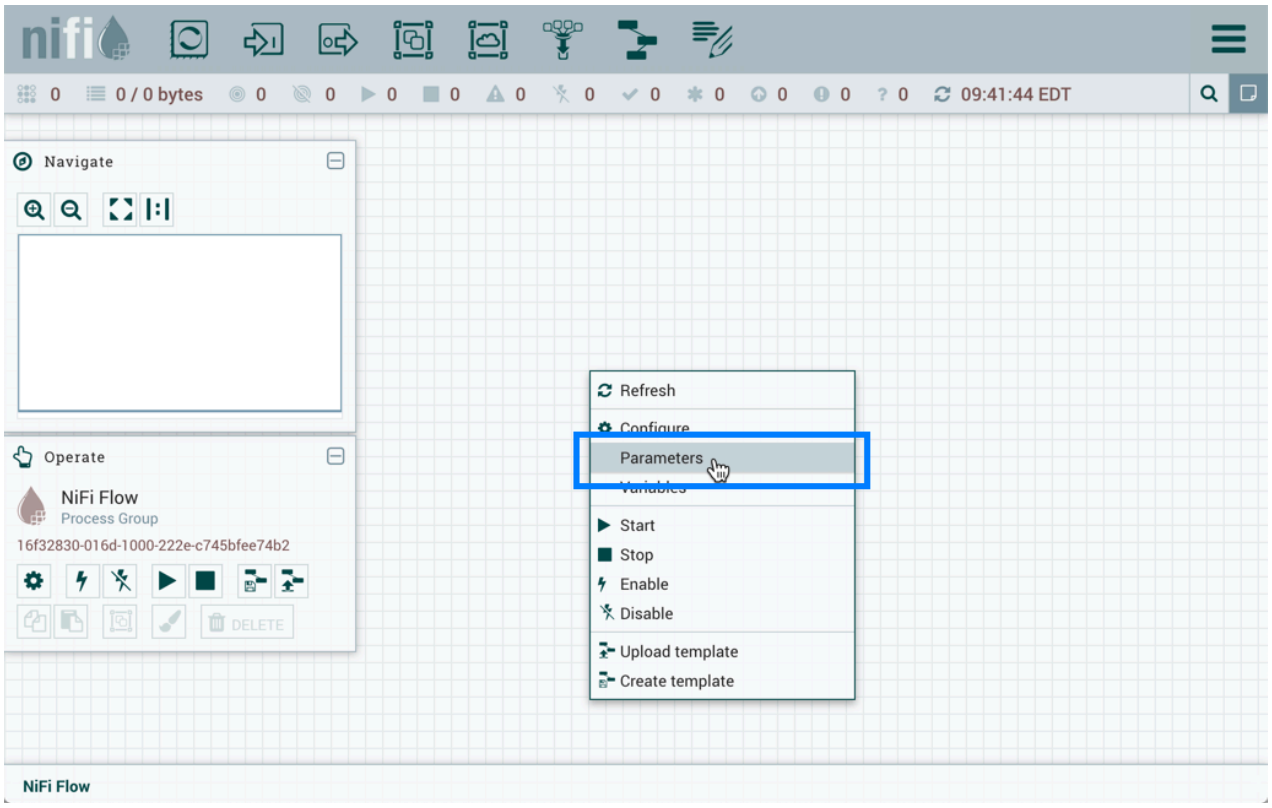
Process Group Name: NiFi Flow

Process Group Parameter Context: No parameter context

- No parameter context
- my_parameter_context
- Create new parameter context...

Last updated: 09:33:08 EDT

Select "Apply" to save the configuration changes. The Process Group context menu now includes a "Parameters" option which allows quick access to the Update Parameter Context window for the assigned Parameter Context.



If the Parameter Context for a Process Group is changed, all components that reference any Parameters in that Process Group will be stopped, validated, and restarted assuming the components were previously running and are still valid.

Note: If a Parameter Context is unset from a Process Group, it does NOT inherit the Parameter Context from the parent Process Group. Instead, no Parameters can be referenced. Any component that does already reference a Parameter will become invalid.

Referencing Parameters

Parameter Reference Syntax

To configure an eligible property to reference a Parameter, use the # symbol as the start, with the Parameter's name enclosed in curly braces:

#{Parameter.Name}

This can be escaped using an additional # character at the beginning. To illustrate this, assume that the Parameter abc has a value of xxx and Parameter def has a value of yyy. Then, the following user-defined property values will evaluate to these effective values:

User-Entered Literal Property Value	Effective Property Value	Explanation
#{abc}	xxx	Simple substitution
#{abc}/data	xxx/data	Simple substitution with additional literal data
#{abc}/#{def}	xxx/yyy	Multiple substitution with additional literal data
#{abc	#{abc	No { } for parameter replacement
#abc	#abc	No { } for parameter replacement
##{abc}	#{abc}	Escaped # for literal interpretation

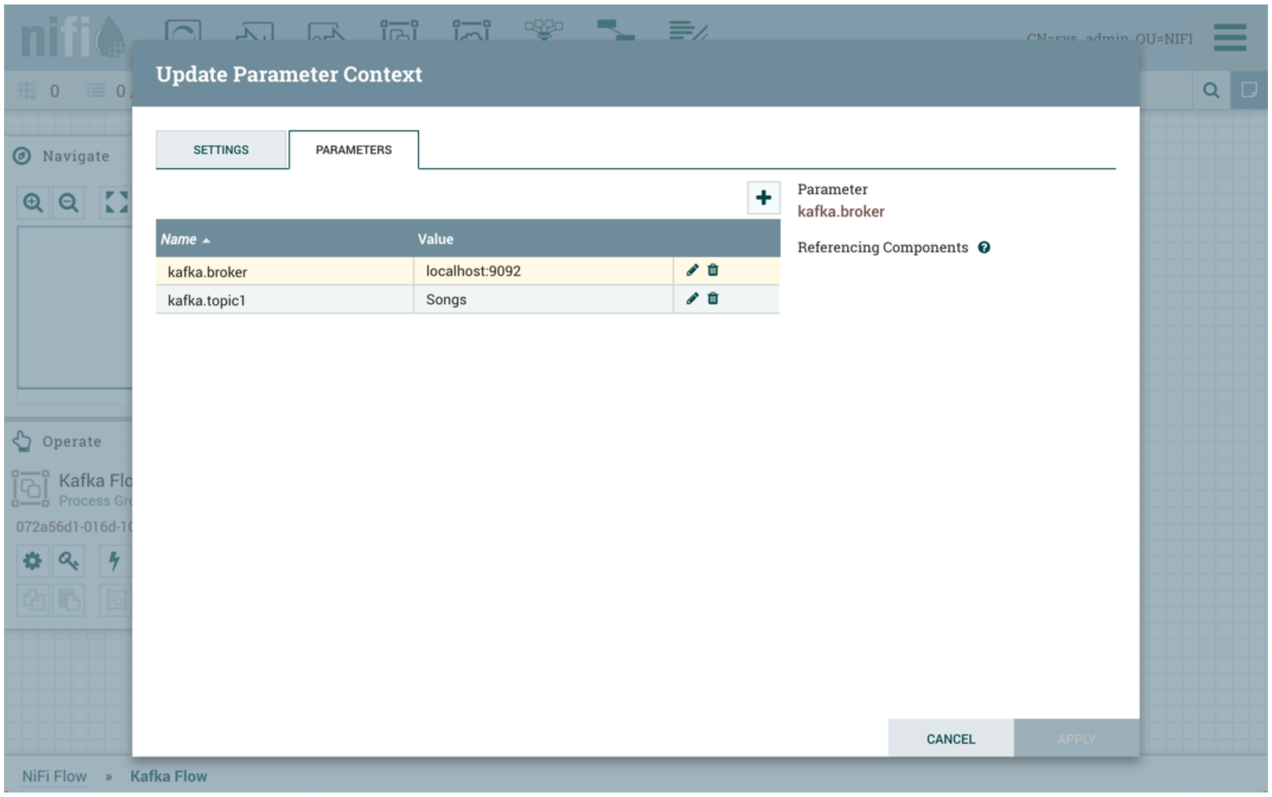
User-Entered Literal Property Value	Effective Property Value	Explanation
###{abc}	#xxx	Escaped # for literal interpretation, followed by simple substitution
####{abc}	##{abc}	Escaped # for literal interpretation, twice
#####{abc}	##xxx	Escaped # for literal interpretation, twice, followed by simple substitution
#{abc/data}	Exception thrown on property set operation	/ not a valid parameter name character

When referencing a Parameter from within Expression Language, the Parameter reference is evaluated first. As an example, to replace xxx with zzz for the abc Parameter:

${ #{abc}:replace('xxx', 'zzz') }

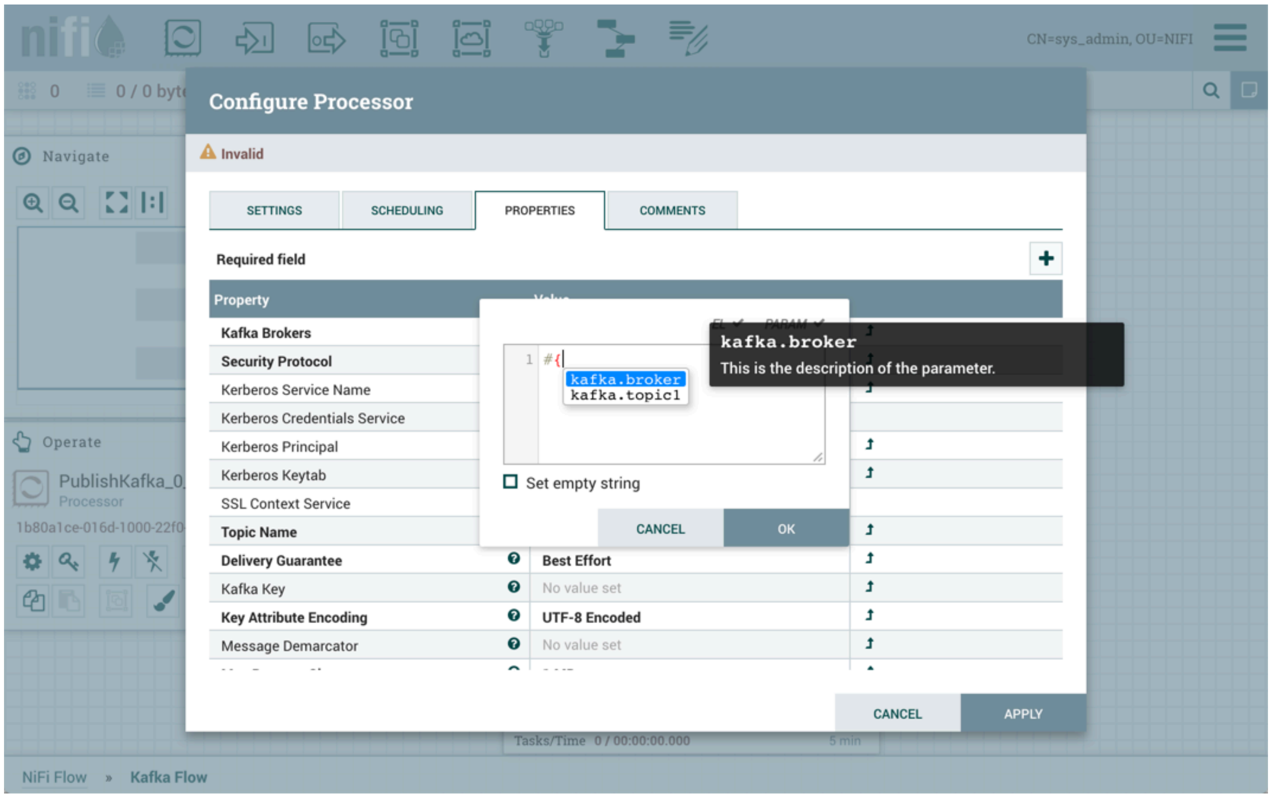
Referencing and Creating Parameters During Component Configuration

Parameters can be easily referenced or created as you configure the components in your flow. For example, assume a process group has the Parameter Context "Kafka Settings" assigned to it. "Kafka Settings" contains the parameters kafka.broker and kafka.topic1.



Name	Value
kafka.broker	localhost:9092
kafka.topic1	Songs

To reference kafka.broker as the value for the "Kafka Brokers" property in the PublishKafka processor, clear the default value and begin a new entry with the start delimiter #{. Next use the keystroke control+space to show the list of available parameters:



Configure Processor

Invalid

SETTINGS SCHEDULING PROPERTIES COMMENTS

Required field

Property	Value
Kafka Brokers	
Security Protocol	
Kerberos Service Name	
Kerberos Credentials Service	
Kerberos Principal	
Kerberos Keytab	
SSL Context Service	
Topic Name	
Delivery Guarantee	Best Effort
Kafka Key	No value set
Key Attribute Encoding	UTF-8 Encoded
Message Demarcator	No value set

```
#{
kafka.broker
kafka.topic1
```

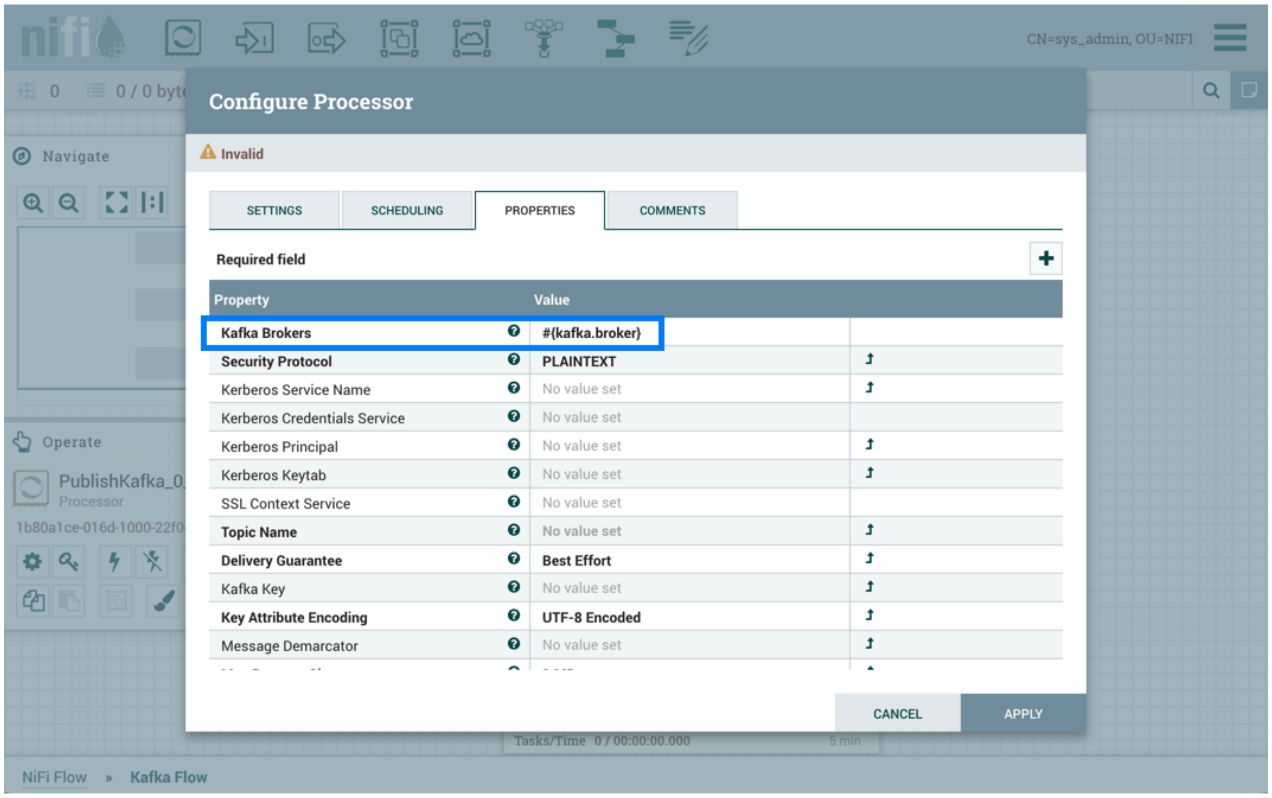
kafka.broker
This is the description of the parameter.

Set empty string

CANCEL OK

CANCEL APPLY

Select kafka.broker and complete the entry with a closing curly brace }.



Configure Processor

Invalid

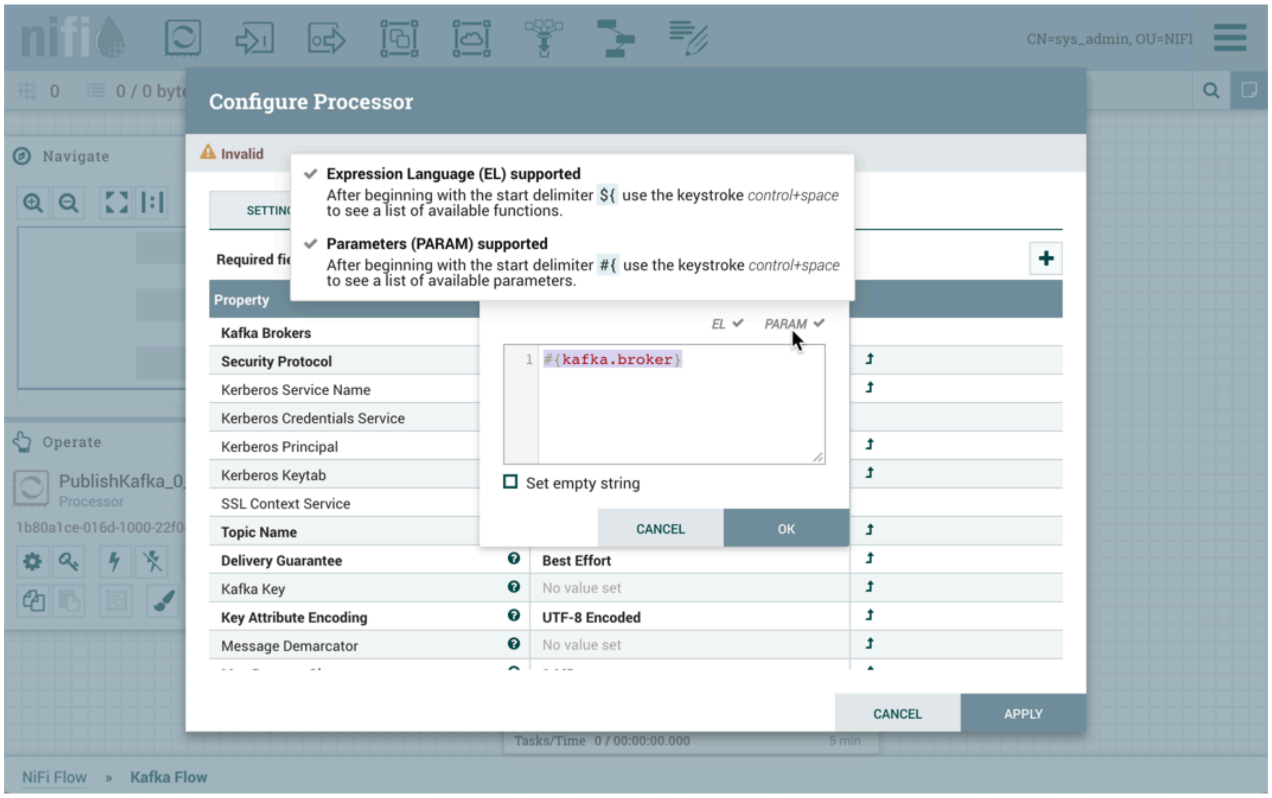
SETTINGS SCHEDULING PROPERTIES COMMENTS

Required field

Property	Value
Kafka Brokers	#{kafka.broker}
Security Protocol	PLAINTEXT
Kerberos Service Name	No value set
Kerberos Credentials Service	No value set
Kerberos Principal	No value set
Kerberos Keytab	No value set
SSL Context Service	No value set
Topic Name	No value set
Delivery Guarantee	Best Effort
Kafka Key	No value set
Key Attribute Encoding	UTF-8 Encoded
Message Demarcator	No value set

CANCEL APPLY

Help text describing this process is displayed when hovering over the Expression Language and Parameters eligibility indicators.



Configure Processor

Invalid

SETTIN

Expression Language (EL) supported
After beginning with the start delimiter `${` use the keystroke *control+space* to see a list of available functions.

Parameters (PARAM) supported
After beginning with the start delimiter `#{` use the keystroke *control+space* to see a list of available parameters.

Required fi

EL ✓ PARAM ✓

```
#{kafka.broker}
```

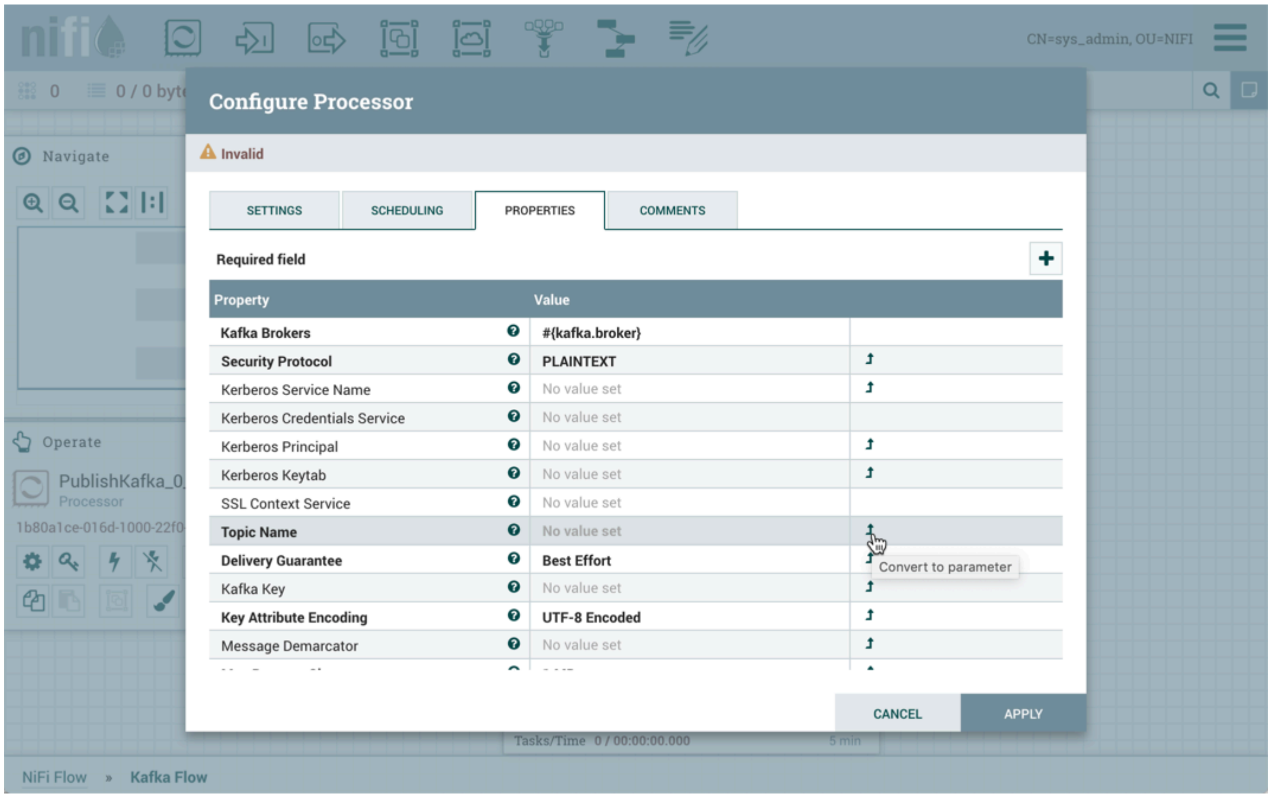
☐ Set empty string

CANCEL OK

Property	Value
Kafka Brokers	
Security Protocol	
Kerberos Service Name	
Kerberos Credentials Service	
Kerberos Principal	
Kerberos Keytab	
SSL Context Service	
Topic Name	
Delivery Guarantee	Best Effort
Kafka Key	No value set
Key Attribute Encoding	UTF-8 Encoded
Message Demarcator	No value set

CANCEL APPLY

Parameters can also be created on the fly. For example, to create a parameter for the "Topic Name" property, select the "Convert to Parameter" icon (↥) in that property's row. This icon will only be available if the user has appropriate permissions to modify the Parameter Context (see Accessing Parameters for more information).



Configure Processor

Invalid

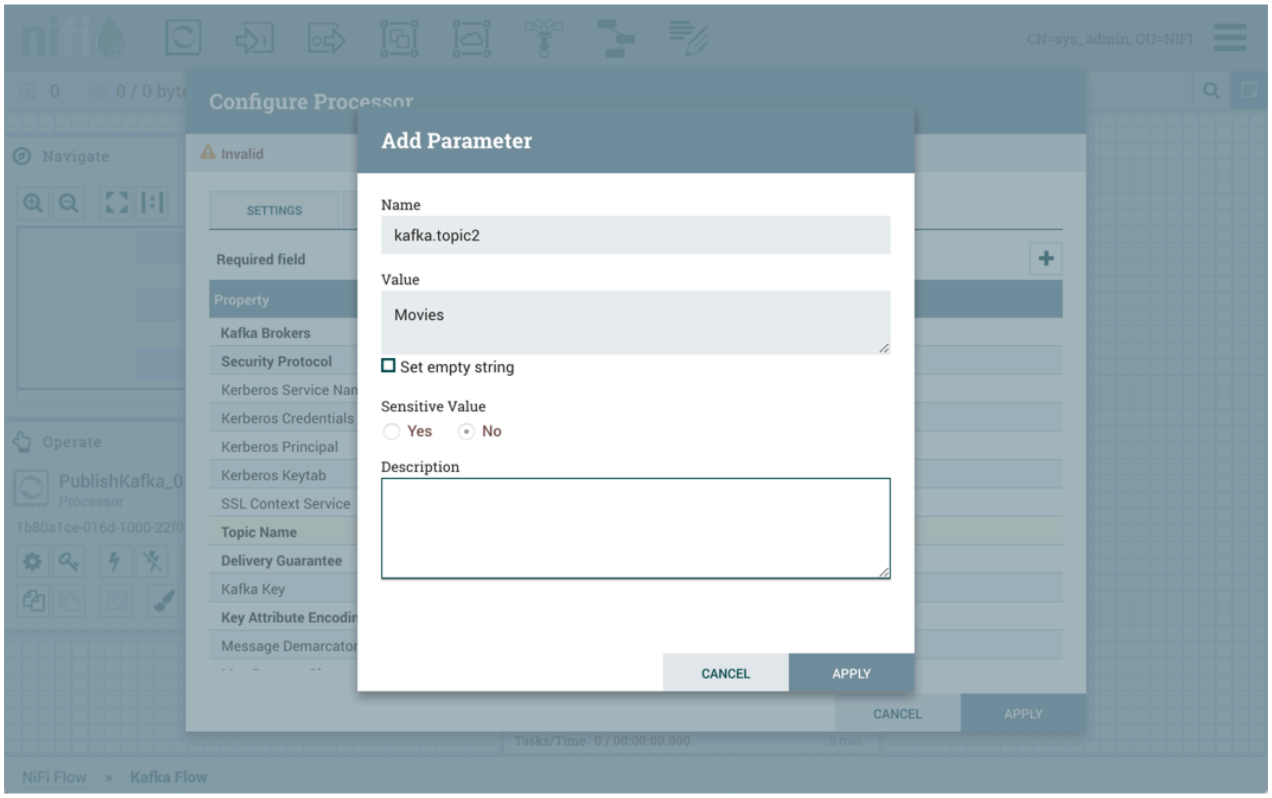
SETTINGS SCHEDULING PROPERTIES COMMENTS

Required field

Property	Value
Kafka Brokers	#{kafka.broker}
Security Protocol	PLAINTEXT
Kerberos Service Name	No value set
Kerberos Credentials Service	No value set
Kerberos Principal	No value set
Kerberos Keytab	No value set
SSL Context Service	No value set
Topic Name	No value set
Delivery Guarantee	Best Effort
Kafka Key	No value set
Key Attribute Encoding	UTF-8 Encoded
Message Demarcator	No value set

CANCEL APPLY

The Add Parameter dialog will open. Configure the new parameter as desired.



Add Parameter

Name: kafka.topic2

Value: Movies

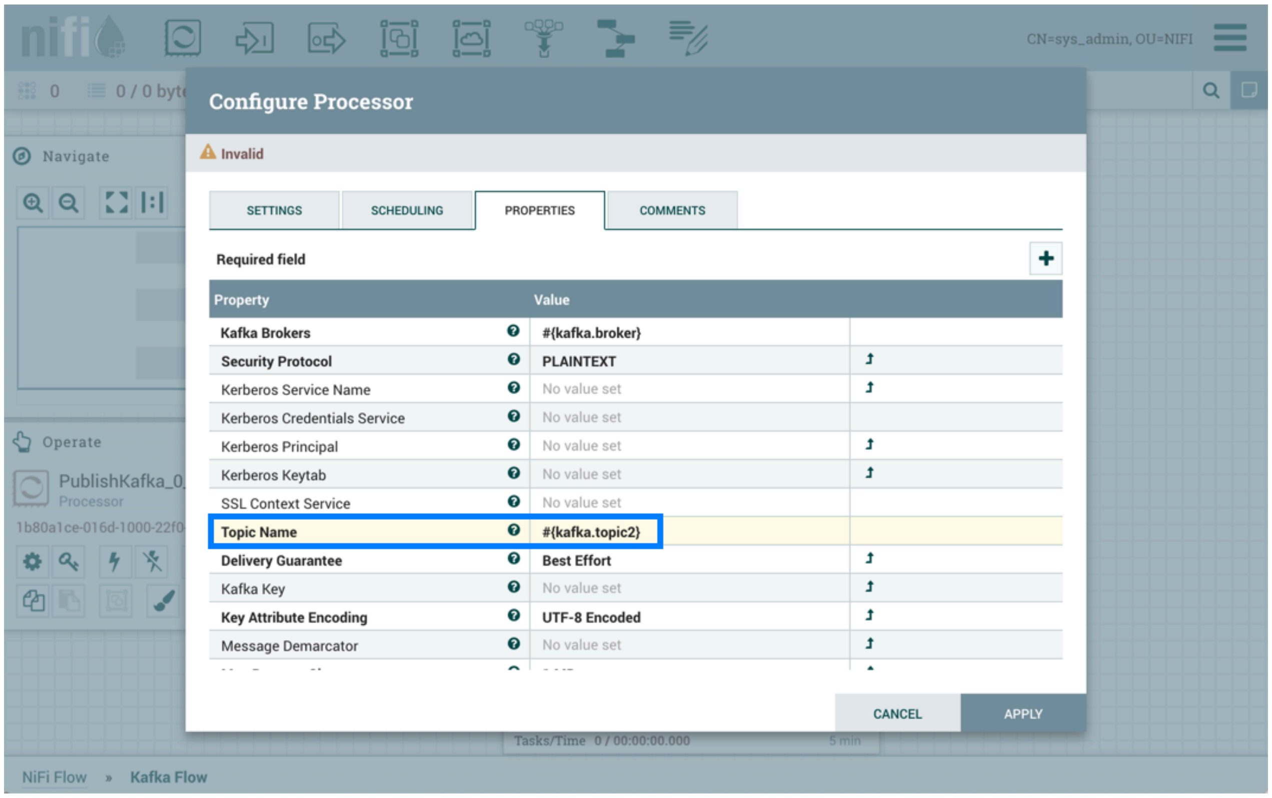
☐ Set empty string

Sensitive Value: Yes [✓ No]

Description:

CANCEL APPLY

Select "Apply". The process group's Parameter Context will be updated and the new parameter will be referenced by the property with the proper syntax applied automatically.



Configure Processor

Invalid

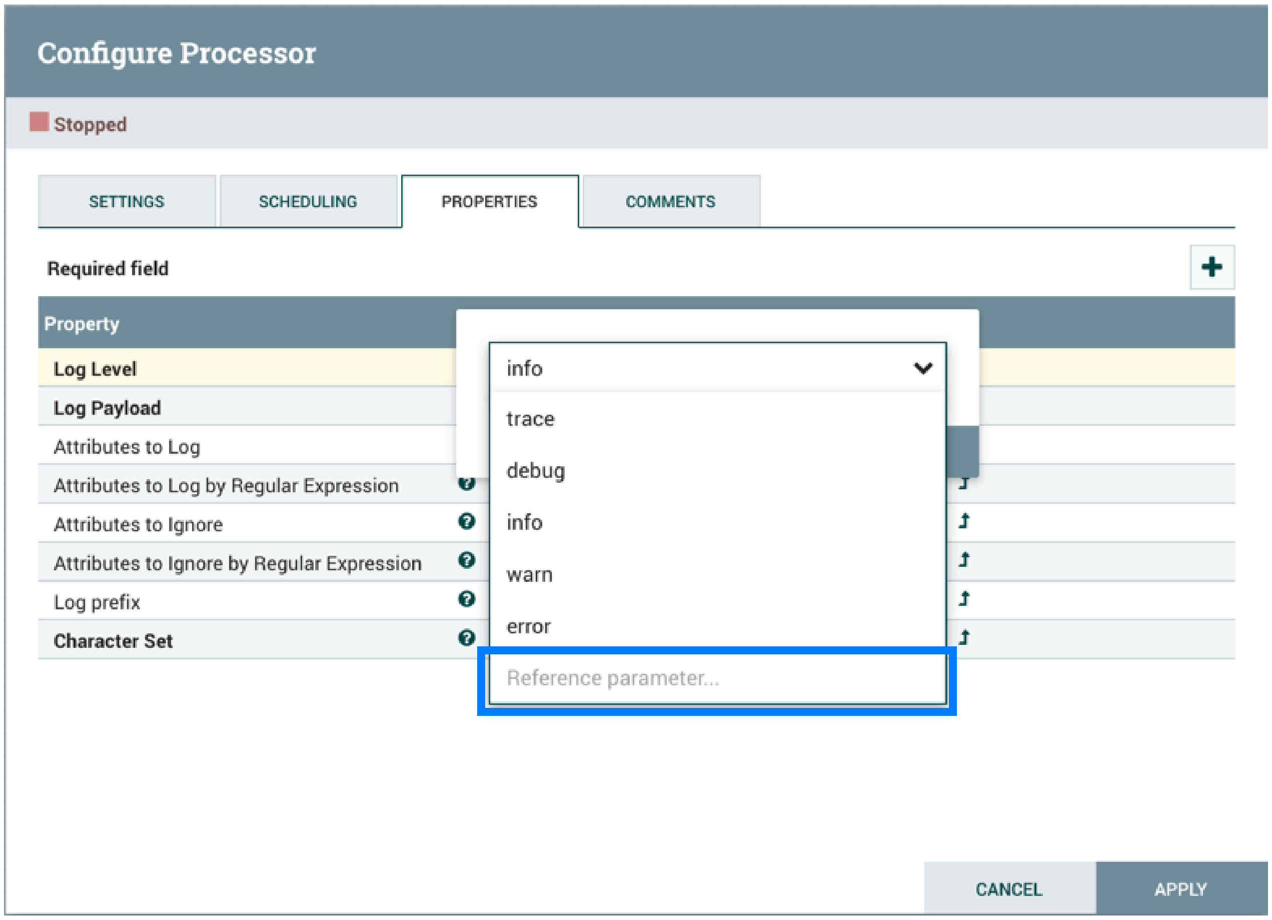
SETTINGS | SCHEDULING | PROPERTIES | COMMENTS

Required field

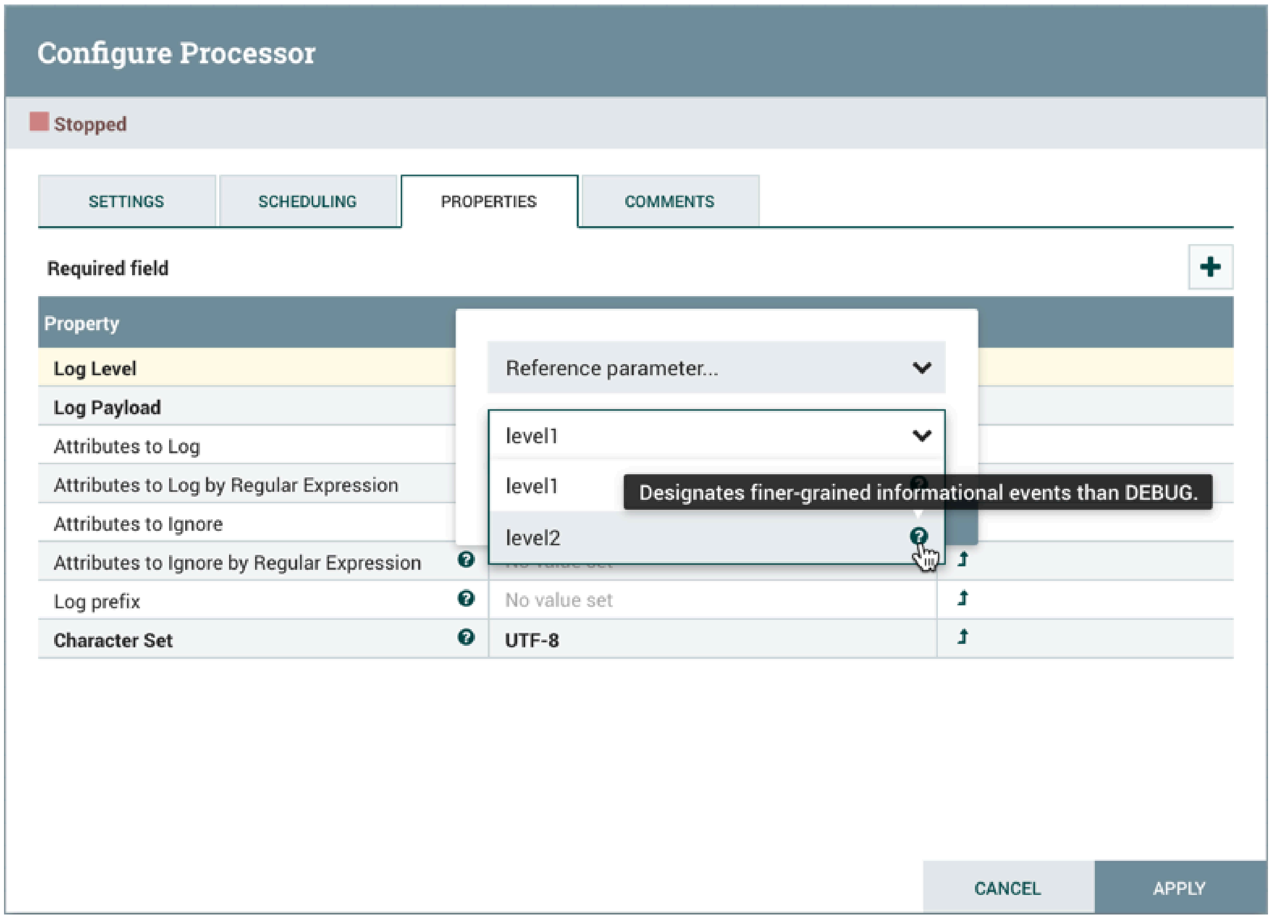
Property	Value
Kafka Brokers	#{kafka.broker}
Security Protocol	PLAINTEXT
Kerberos Service Name	No value set
Kerberos Credentials Service	No value set
Kerberos Principal	No value set
Kerberos Keytab	No value set
SSL Context Service	No value set
Topic Name	#{kafka.topic2}
Delivery Guarantee	Best Effort
Kafka Key	No value set
Key Attribute Encoding	UTF-8 Encoded
Message Demarcator	No value set

CANCEL APPLY

Properties values that are selectable can also reference parameters. In addition to applying the "Convert to Parameter" method described earlier, the option "Reference parameter.." is available in the value drop-down menu.



Selecting "Reference parameter…" will display a drop-down list of available parameters, determined by the parameter context assigned to the component's process group and the user's access policies.



Property	Value
Log Level	
Log Payload	
Attributes to Log	
Attributes to Log by Regular Expression	
Attributes to Ignore	
Attributes to Ignore by Regular Expression	
Log prefix	No value set
Character Set	UTF-8

Hovering over the question mark icon ( ) displays the parameter's description.

Using Parameters with Sensitive Properties

Sensitive properties may only reference sensitive Parameters. This is important for versioned flows. The value of the sensitive Parameter itself will NOT be sent to the flow registry, only the fact that the property references the sensitive Parameter. For more information see Parameters in Versioned Flows.

The value of a sensitive property must be set to a single Parameter reference. For example, values of #{password}123 and #{password}#{suffix} are not allowed. Sending #{password}123 would lead to exposing part of the sensitive property's value. This is in contrast to a non-sensitive property, where a value such as #{path}/child/file.txt is valid.

Accessing Parameters

User privileges to Parameters are managed via access policies on the following levels:

- Parameter Context
- Process Group
- Component

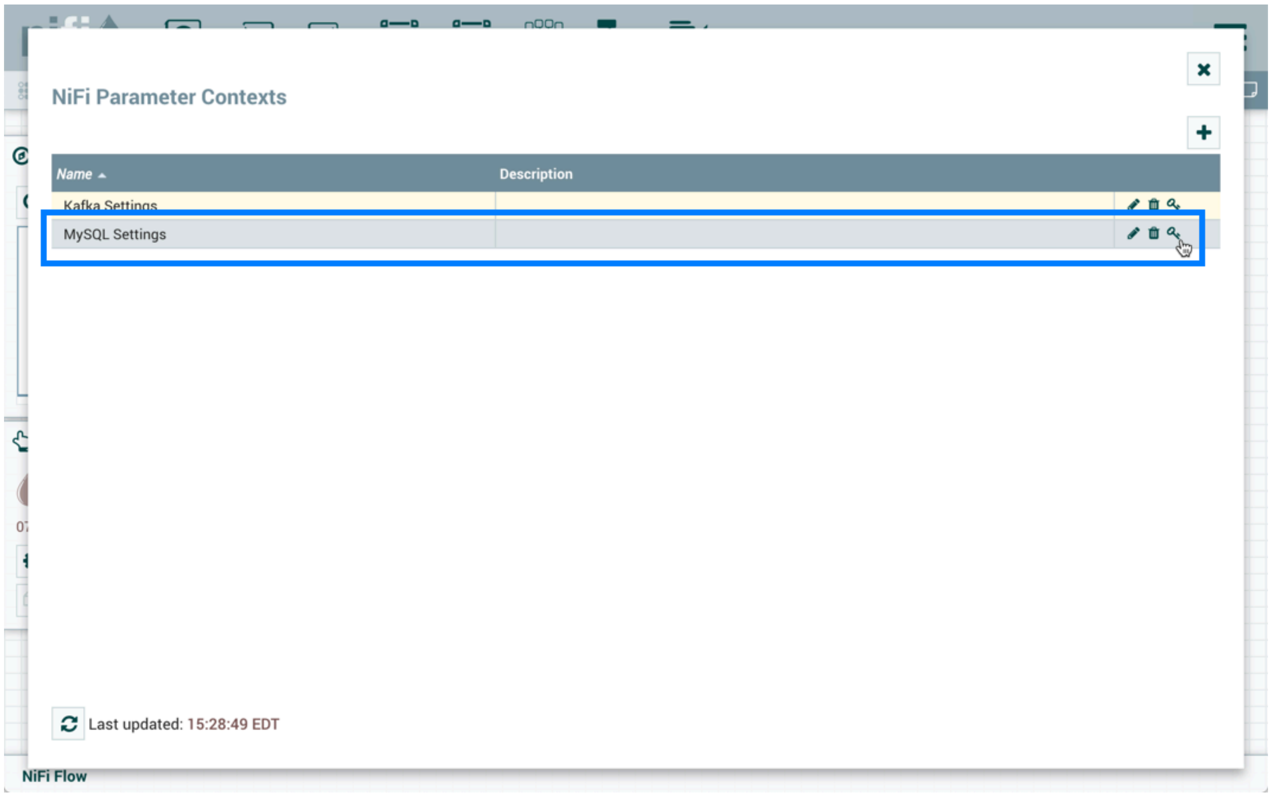
Note: For additional information on how to configure access policies, see the Access Policies section in the *System Administrator's Guide*.

Parameter Context Access Policies

For a user to see Parameter Contexts, they must be added to either the "access the controller" view policy or the "access parameter contexts" view policy. For a user to modify Parameter Contexts, they must also be added to the corresponding modify policies. These policies are accessed via "Policies" from the Global Menu. See the Access Policies section in the *System Administrator's Guide* for more information.

Note: The "access parameter contexts" policies are inherited from the "access the controller" policies unless overridden.

View and modify policies can also be set on individual parameter contexts to determine which users can view or add parameters to the context. Select "Parameter Contexts" from the Global Menu. Select the "Access Policies" button ( ) in the row of the desired parameter context to manage these policies.


NiFi Parameter Contexts

Name	Description
Kafka Settings	
MySQL Settings	

Last updated: 15:28:49 EDT

See the Component Level Access Policies section in the *System Administrator's Guide* for more information.

Process Group Access Policies

A user can only set the Parameter Context of a Process Group to one of the Parameter Contexts that the user has the view policy for. Additionally, in order to set the Parameter Context, the user must have the modify policy for the Process Group. The Process Group access policies can be managed by highlighting the Process Group and selecting the "Access Policies" button ( ) from the Operate Palette.

Component Access Policies

To reference Parameters or convert properties to a Parameter in a component, a user needs to have the view and modify policies for the component. These policies are inherited if the user has view and modify policies to the component's process group, but these policies can be overridden on the component level.

In order to modify a Parameter, a user must have view and modify policies for any and all components that reference that Parameter. This is needed because changing the Parameter requires that the components be stopped/started and also because by taking that action, the user is modifying the behavior of the component.

See the Component Level Access Policies section in the System Administrator's Guide for more information.

Using Custom Properties with Expression Language

You can use NiFi Expression Language to reference FlowFile attributes, compare them to other values, and manipulate their values when you are creating and configuring dataflows. For more information on Expression Language, see the Expression Language Guide.

In addition to using FlowFile attributes, system properties, and environment properties within Expression Language, you can also define custom properties for Expression Language use. Defining custom properties gives you more flexibility in handling and processing dataflows. You can also create custom properties for connection, server, and service properties, for easier dataflow configuration.

NiFi properties have resolution precedence of which you should be aware when creating custom properties:

- Processor-specific attributes
- FlowFile properties
- FlowFile attributes
- From Variable Registry:
  - User defined properties (custom properties)
  - System properties
  - Operating System environment variables

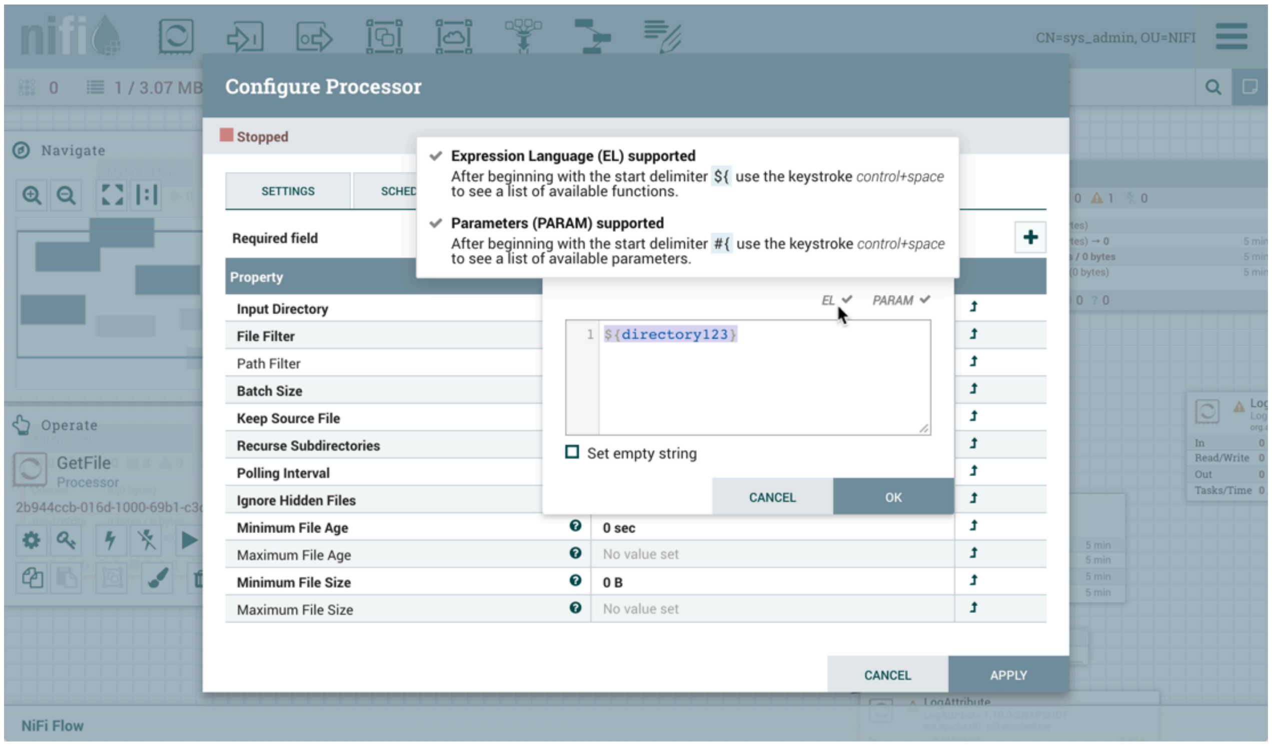
When you are creating custom properties, ensure that each custom property contains a distinct property value, so that it is not overridden by existing environment properties, system properties, or FlowFile attributes.

There are two ways to use and manage custom properties with Expression Language:

- Variables: Variables are created and configured within the NiFi UI. They can be used in any field that supports Expression Language. Variables cannot be used for sensitive properties. NiFi automatically picks up new or modified variables. Variables are defined at the Process Group level, as a result, the access policies for viewing and changing variables are derived from the access policies of the Process Group. See Variables for more information.
- Custom Properties File: Key/value pairs are defined in a custom properties file that is referenced via the nifi.variable.registry.properties in nifi.properties. NiFi must be restarted for updates to be picked up. See Referencing Custom Properties via nifi.properties for more information.

Note: Custom properties via Variables and the nifi.properties file are still supported for compatibility purposes but do not have the same power as Parameters such as support for sensitive properties and more granular control over who can create, modify or use them. Variables and the nifi.variable.registry.properties property will be removed in a future release. As a result, it is highly recommended to switch to Parameters.

Expression Language support for a property is indicated in the UI.



Expression Language (EL) supported
After beginning with the start delimiter ${ use the keystroke control+space to see a list of available functions.

Parameters (PARAM) supported
After beginning with the start delimiter #{ use the keystroke control+space to see a list of available parameters.

Required field

```
${directory123}
```

Set empty string

Property	Value
Input Directory	
File Filter	
Path Filter	
Batch Size	
Keep Source File	
Recurse Subdirectories	
Polling Interval	
Ignore Hidden Files	
Minimum File Age	0 sec
Maximum File Age	No value set
Minimum File Size	0 B
Maximum File Size	No value set

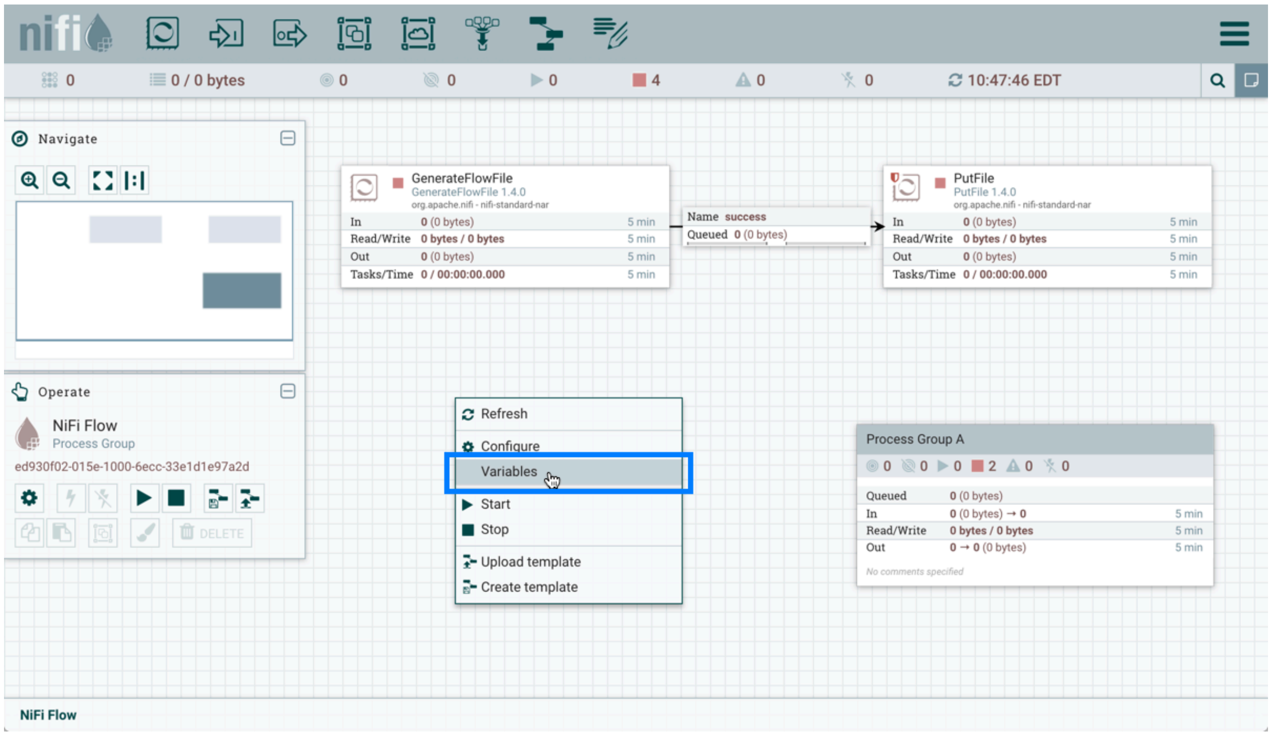
Variables

Note: Custom properties via Variables and the nifi.properties file are still supported for compatibility purposes but do not have the same power as Parameters such as support for sensitive properties and more granular control over who can create, modify or use them. Variables and the nifi.variable.registry.properties property will be removed in a future release. As a result, it is highly recommended to switch to Parameters.

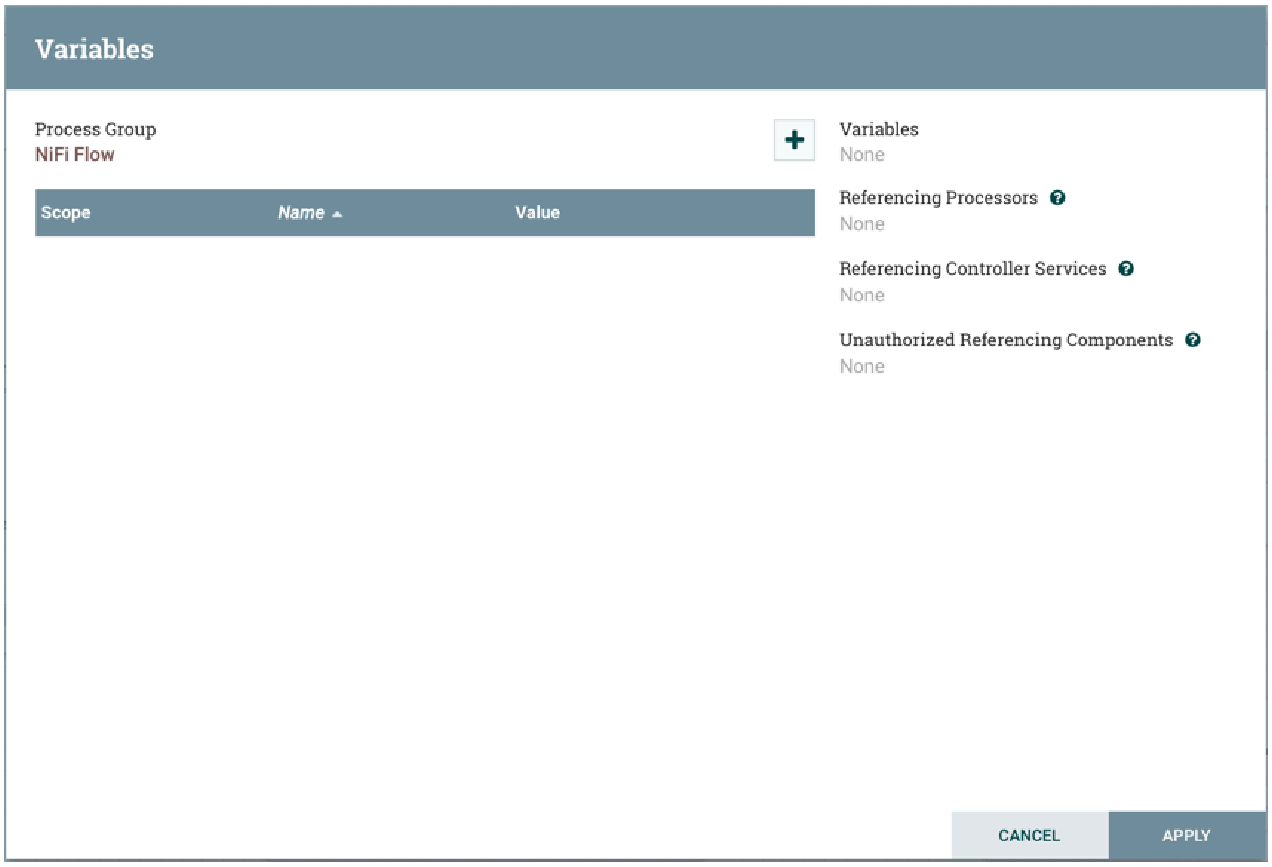
Variables are created and configured within the NiFi UI. They can be used in any field that supports Expression Language. Variables cannot be used for sensitive properties. Variables are defined at the Process Group level, as a result, the access policies for viewing and changing variables are derived from the access policies of the Process Group. Variable values cannot reference other variables or make use of Expression Language.

Variables Window

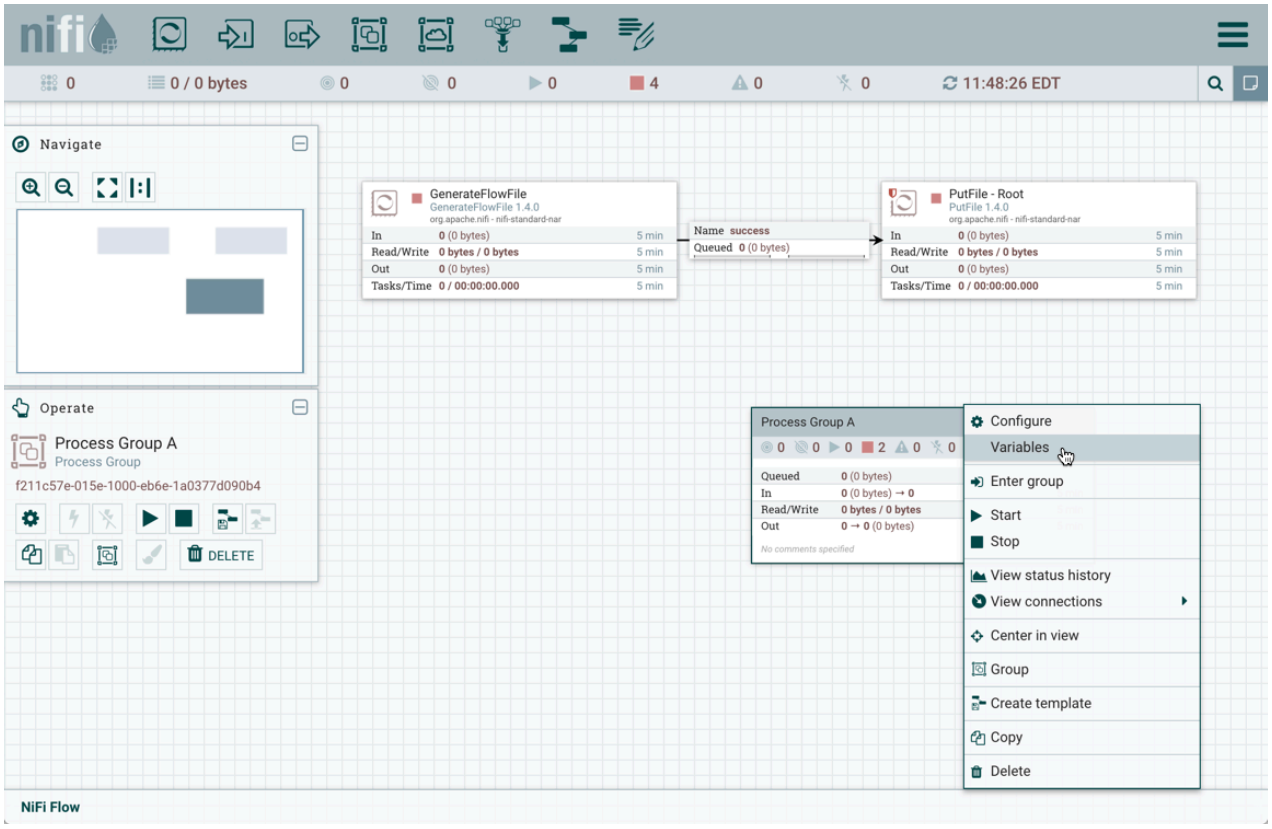
To access the Variables window, right-click on the canvas with nothing selected:



Select "Variables" from the Context Menu:

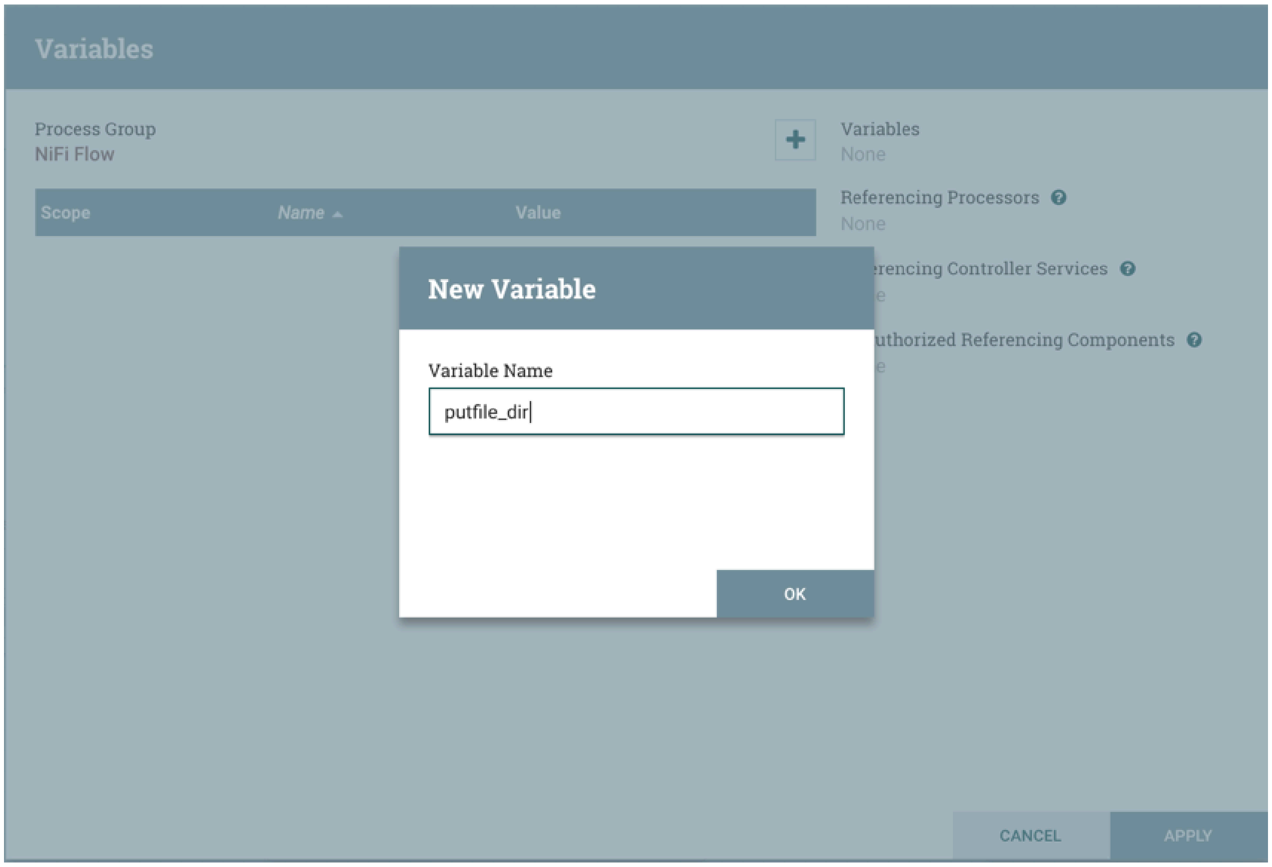


"Variables" is also available in the right-click Context Menu when a process group is selected:

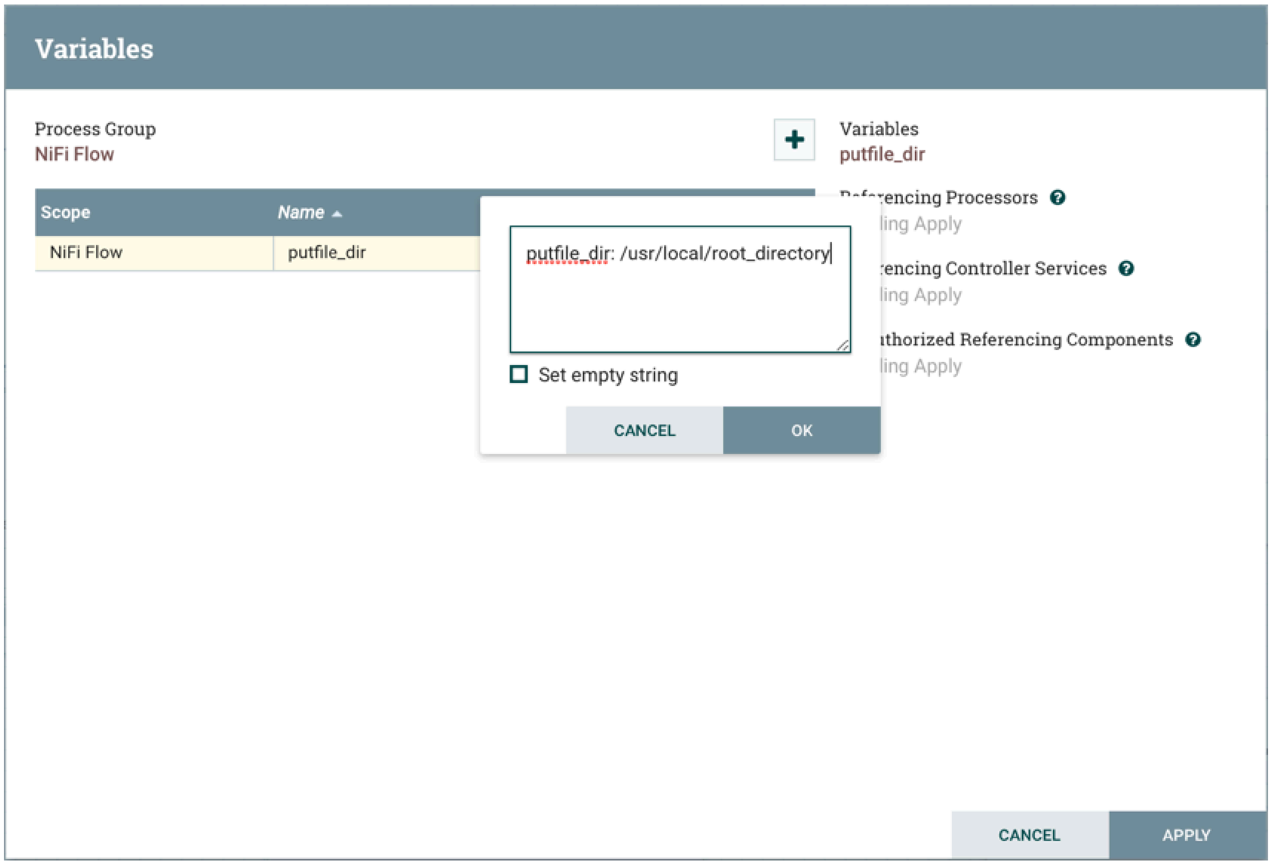


Creating a Variable

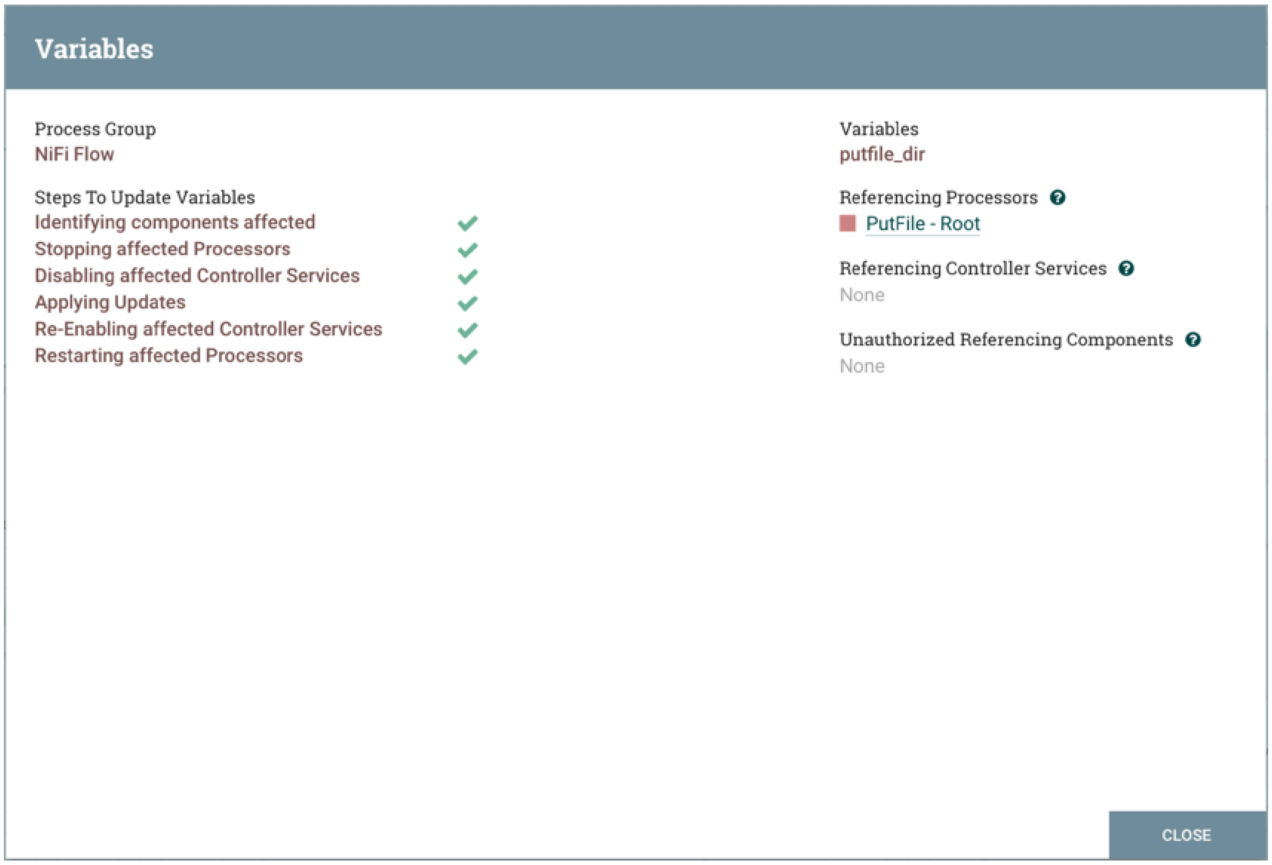
In the Variables window, click the + button to create a new variable. Add a name:


Variables
Process Group
NiFi Flow
Scope
Name
Value
Variables
None
Referencing Processors
None
erencing Controller Services
uthorized Referencing Components
New Variable
Variable Name
putfile_dir
OK
CANCEL
APPLY

and a value:


Variables
Process Group
NiFi Flow
Scope
Name
NiFi Flow
putfile_dir
Variables
putfile_dir
Referencing Processors
ling Apply
encing Controller Services
ling Apply
thorized Referencing Components
ling Apply
putfile_dir: /usr/local/root_directory
Set empty string
CANCEL
OK
CANCEL
APPLY

Select "Apply":



Variables

Process Group
NiFi Flow

Steps To Update Variables

Identifying components affected	✓
Stopping affected Processors	✓
Disabling affected Controller Services	✓
Applying Updates	✓
Re-Enabling affected Controller Services	✓
Restarting affected Processors	✓

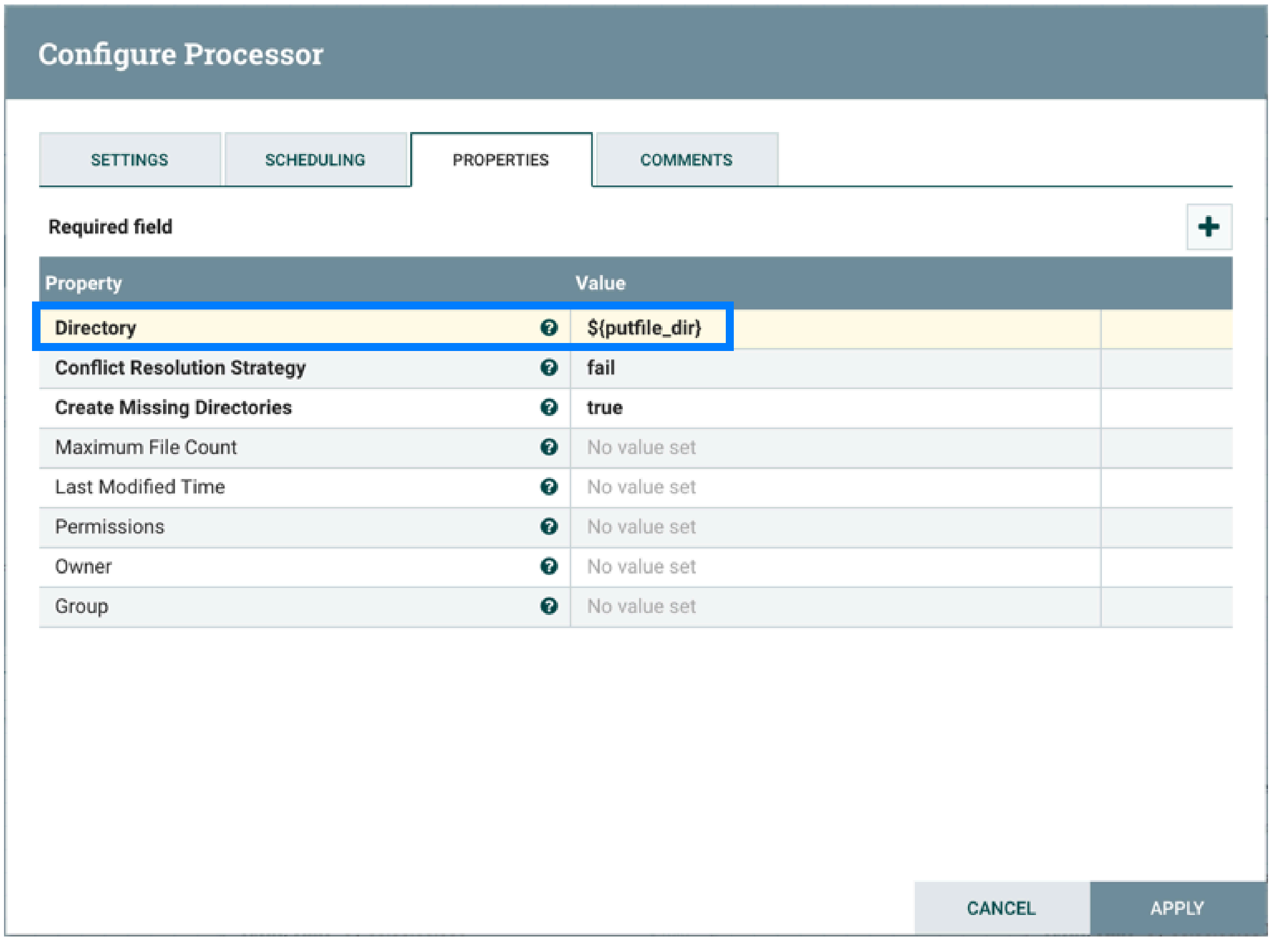
Variables
putfile_dir

Referencing Processors
PutFile - Root

Referencing Controller Services
None

Unauthorized Referencing Components
None

Steps to update the variable are performed (Identifying components affected, Stopping affected Processors, etc.). For example, the Referencing Processors section now lists the "PutFile-Root" processor. Selecting the name of the processor in the list will navigate to that processor on the canvas. Looking at the properties of the processor, ${putfil e_dir} is referenced by the Directory property:



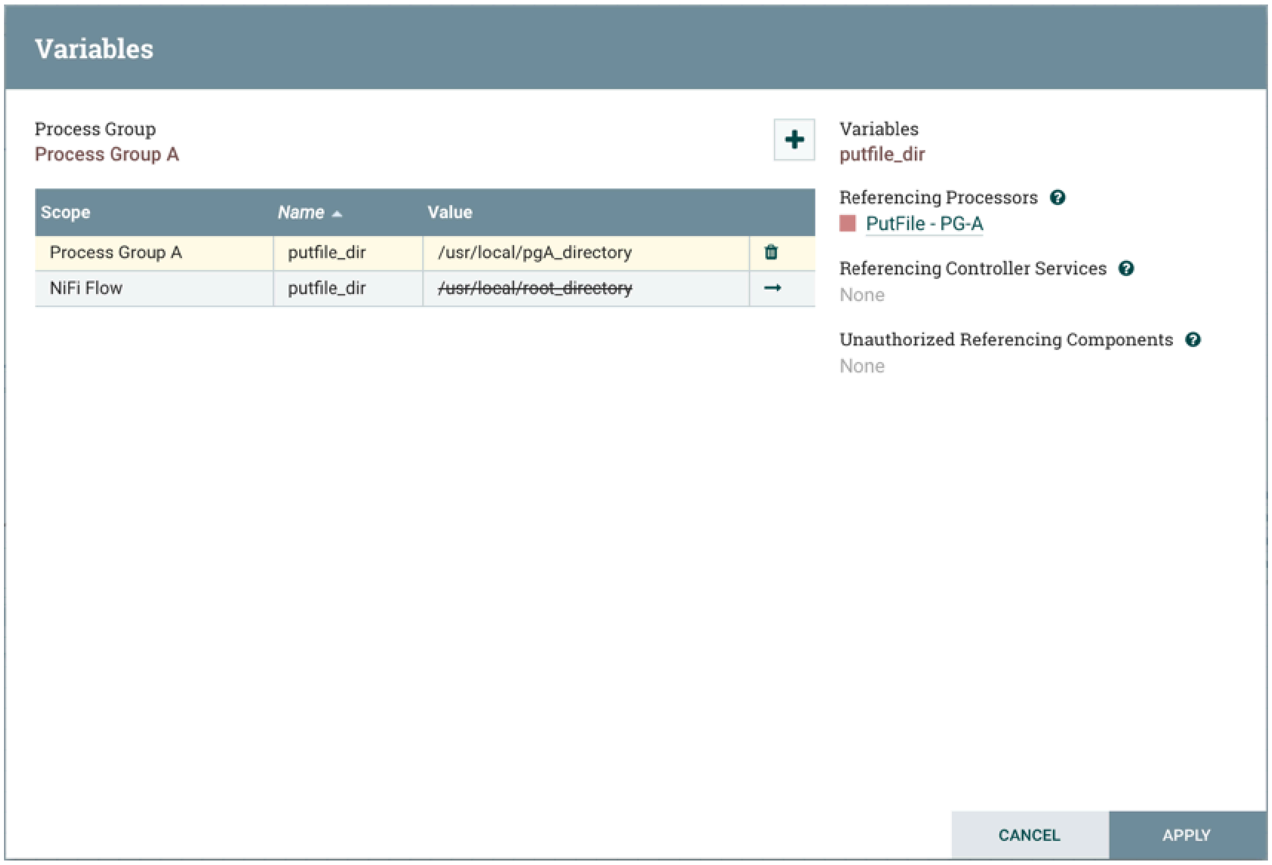
Property	Value
Directory	${putfile_dir}
Conflict Resolution Strategy	fail
Create Missing Directories	true
Maximum File Count	No value set
Last Modified Time	No value set
Permissions	No value set
Owner	No value set
Group	No value set

Variable Scope

Variables are scoped by the Process Group they are defined in and are available to any Processor defined at that level and below (i.e. any descendant Processors).

Variables in a descendant group override the value in a parent group. More specifically, if a variable x is declared at the root group and also declared inside a process group, components inside the process group will use the value of x defined in the process group.

For example, in addition to the putfile_dir variable that exists at the root process group, assume another putfile_dir variable was created within Process Group A. If one of the components within Process Group A references putfile_dir, both variables will be listed, but the putfile_dir from the root group will have a strikethrough indicating that is is being overridden:



Variables

Process Group
Process Group A

Scope	Name	Value	
Process Group A	putfile_dir	/usr/local/pgA_directory	
NiFi Flow	putfile_dir	~~/usr/local/root_directory~~	→

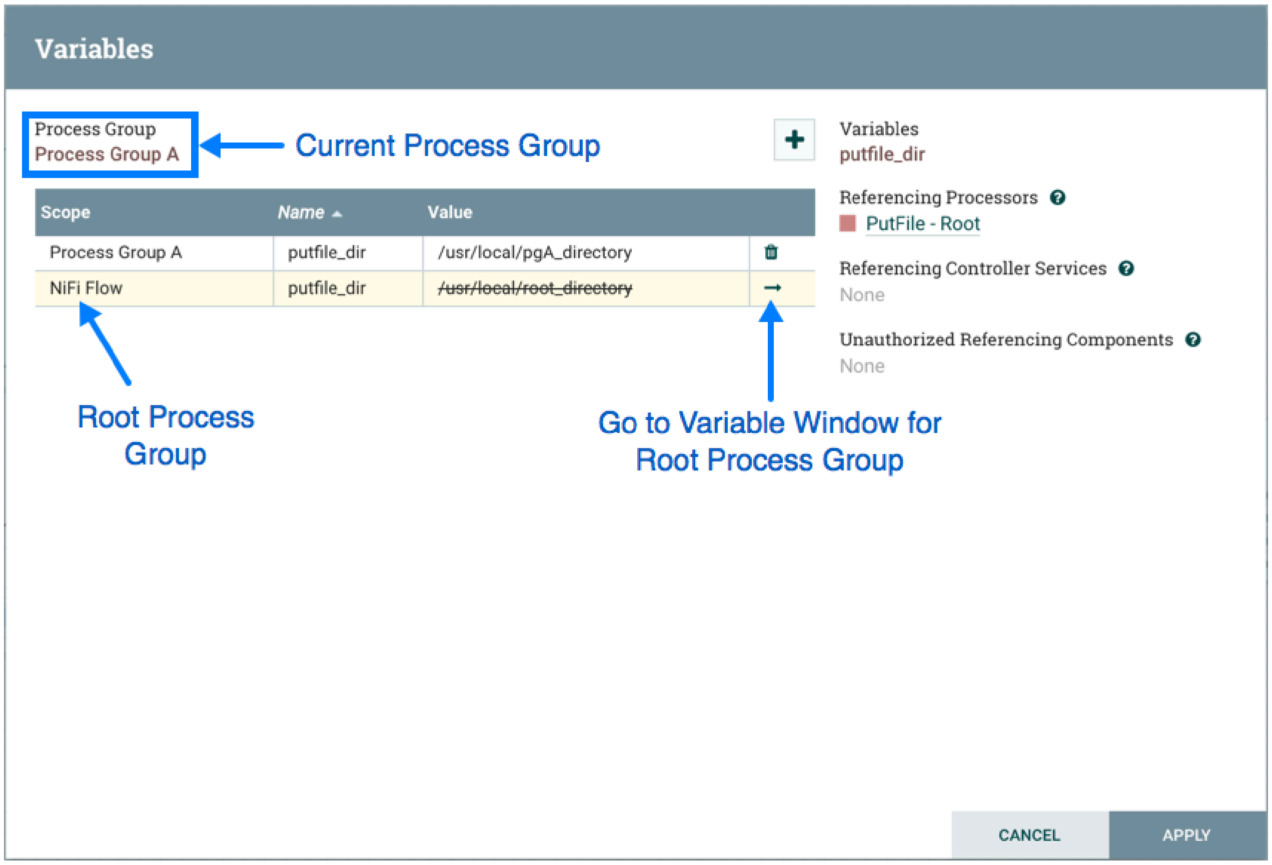
Variables
putfile_dir

Referencing Processors
PutFile - PG-A

Referencing Controller Services
None

Unauthorized Referencing Components
None

A variable can only be modified for the process group it was created in, which is listed at the top of the Variables window. To modify a variable defined in a different process group, select the "arrow" icon in that variable's row:



Process Group
Process Group A

Scope	Name	Value
Process Group A	putfile_dir	/usr/local/pgA_directory
NiFi Flow	putfile_dir	~~/usr/local/root_directory~~

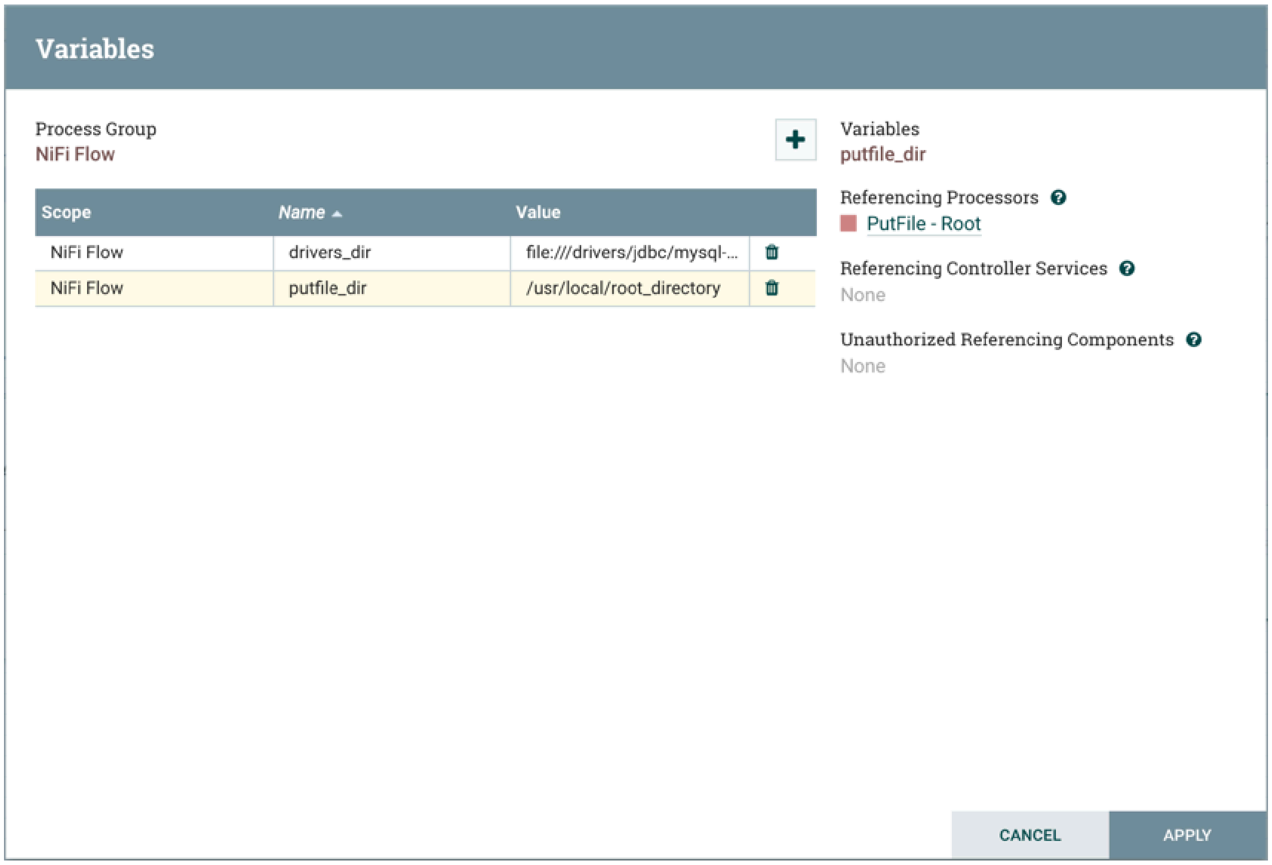
Variables
putfile_dir

Referencing Processors
🟥 PutFile - Root

Referencing Controller Services
None

Unauthorized Referencing Components
None

which will navigate to the Variables window for that process group:



Process Group
NiFi Flow

Scope	Name	Value
NiFi Flow	drivers_dir	file:///drivers/jdbc/mysql-...
NiFi Flow	putfile_dir	/usr/local/root_directory

Variables
putfile_dir

Referencing Processors
🟥 PutFile - Root

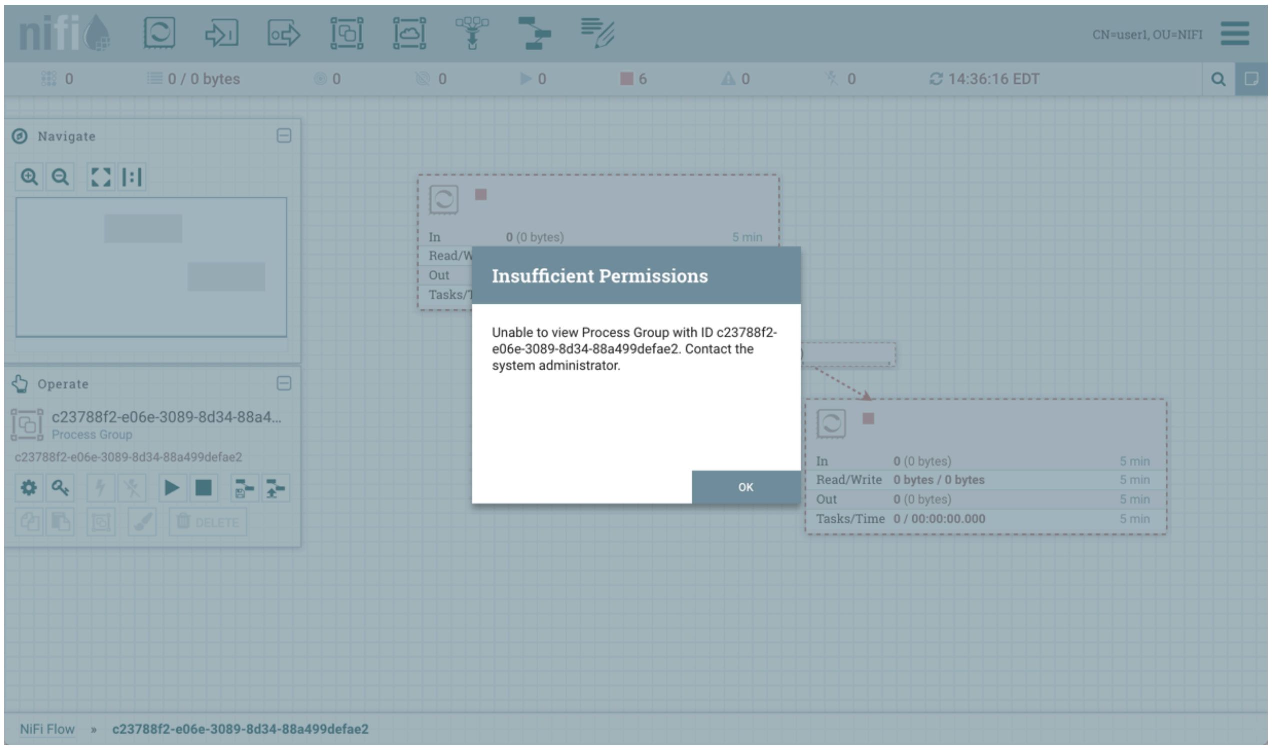
Referencing Controller Services
None

Unauthorized Referencing Components
None

Variable Permissions

Variable permissions are based solely on the privileges configured on the corresponding Process Group.

For example, if a user does not have access to View a process group, the Variables window can not be viewed for that process group:


CN=user1, OU=NIFI
0 / 0 bytes
14:36:16 EDT
Navigate
Operate
c23788f2-e06e-3089-8d34-88a4...
Process Group
c23788f2-e06e-3089-8d34-88a499defae2
DELETE
Insufficient Permissions
OK
NiFi Flow » c23788f2-e06e-3089-8d34-88a499defae2

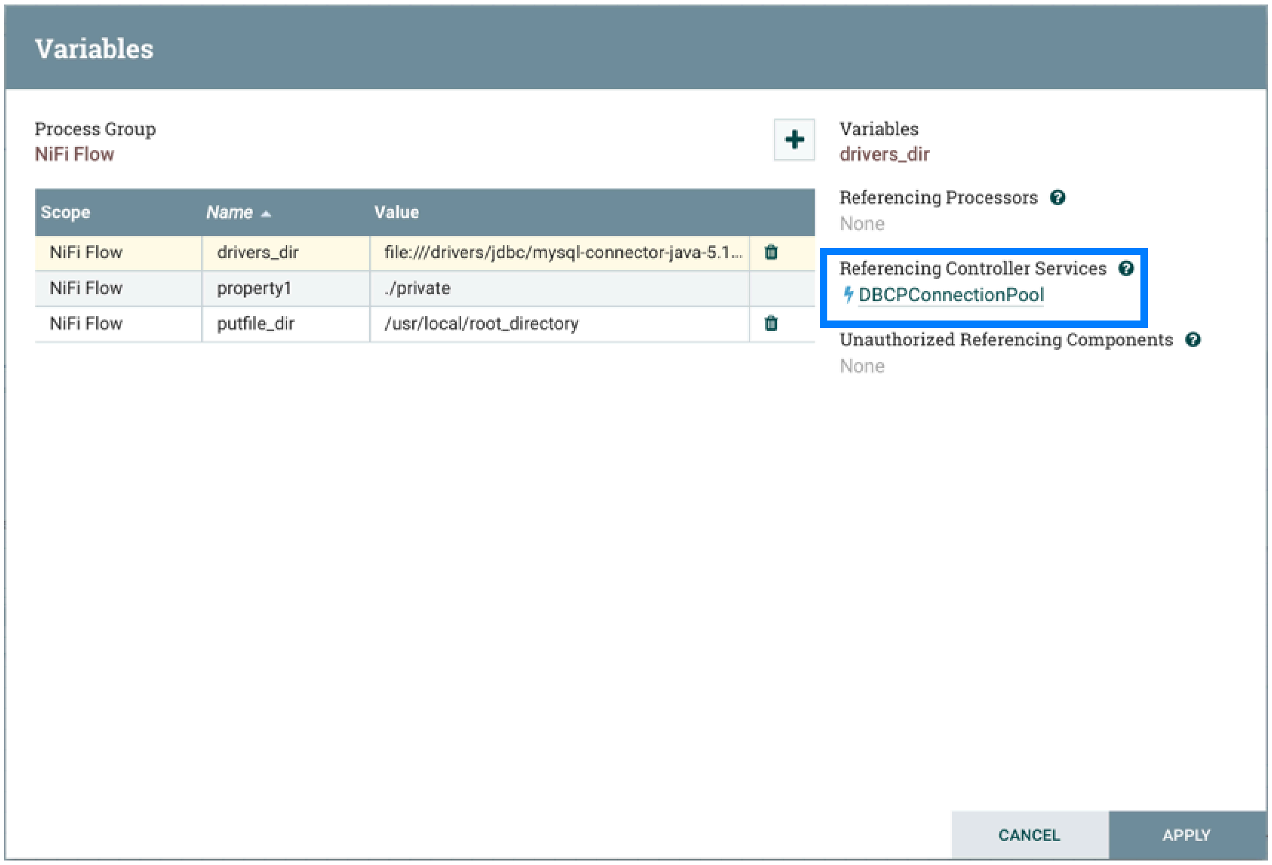
Unable to view Process Group with ID c23788f2-e06e-3089-8d34-88a499defae2. Contact the system administrator.

If a user has access to View a process group but does not have access to Modify the process group, the variables can be viewed but not modified.

For information on how to manage privileges on components, see the Access Policies section in the *System Administrator's Guide*.

Referencing Controller Services

In addition to Referencing Processors, the Variables window also displays Referencing Controller Services:



Variables

Process Group
NiFi Flow

Scope	Name	Value
NiFi Flow	drivers_dir	file:///drivers/jdbc/mysql-connector-java-5.1...
NiFi Flow	property1	./private
NiFi Flow	putfile_dir	/usr/local/root_directory

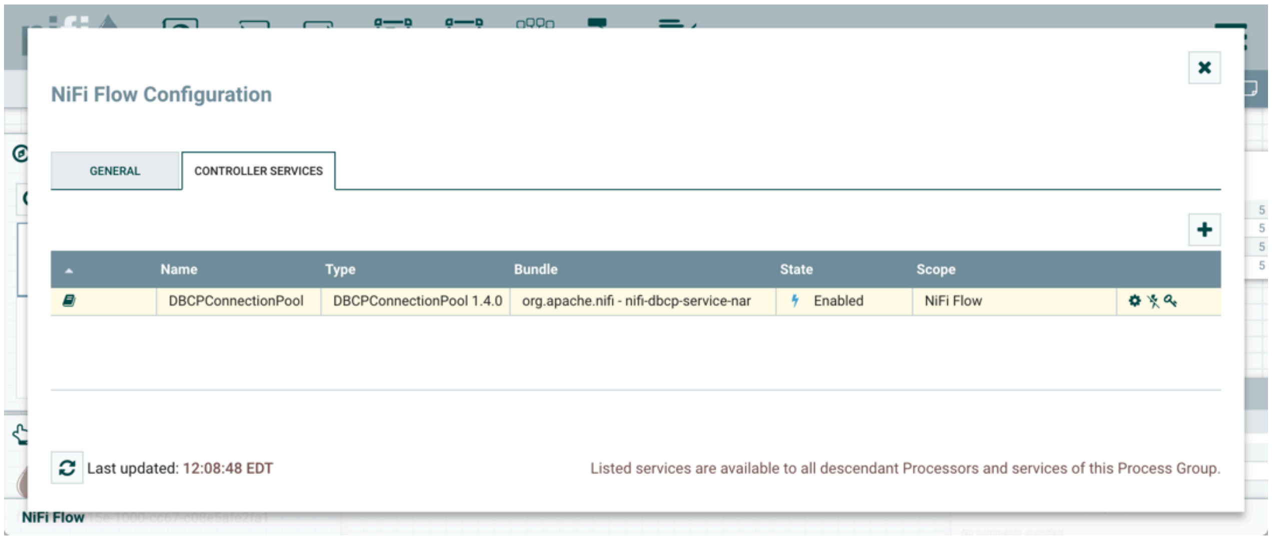
Variables
drivers_dir

Referencing Processors
None

Referencing Controller Services
DBCPConnectionPool

Unauthorized Referencing Components
None

Selecting the name of the controller service will navigate to that controller service in the Configuration window:



NiFi Flow Configuration

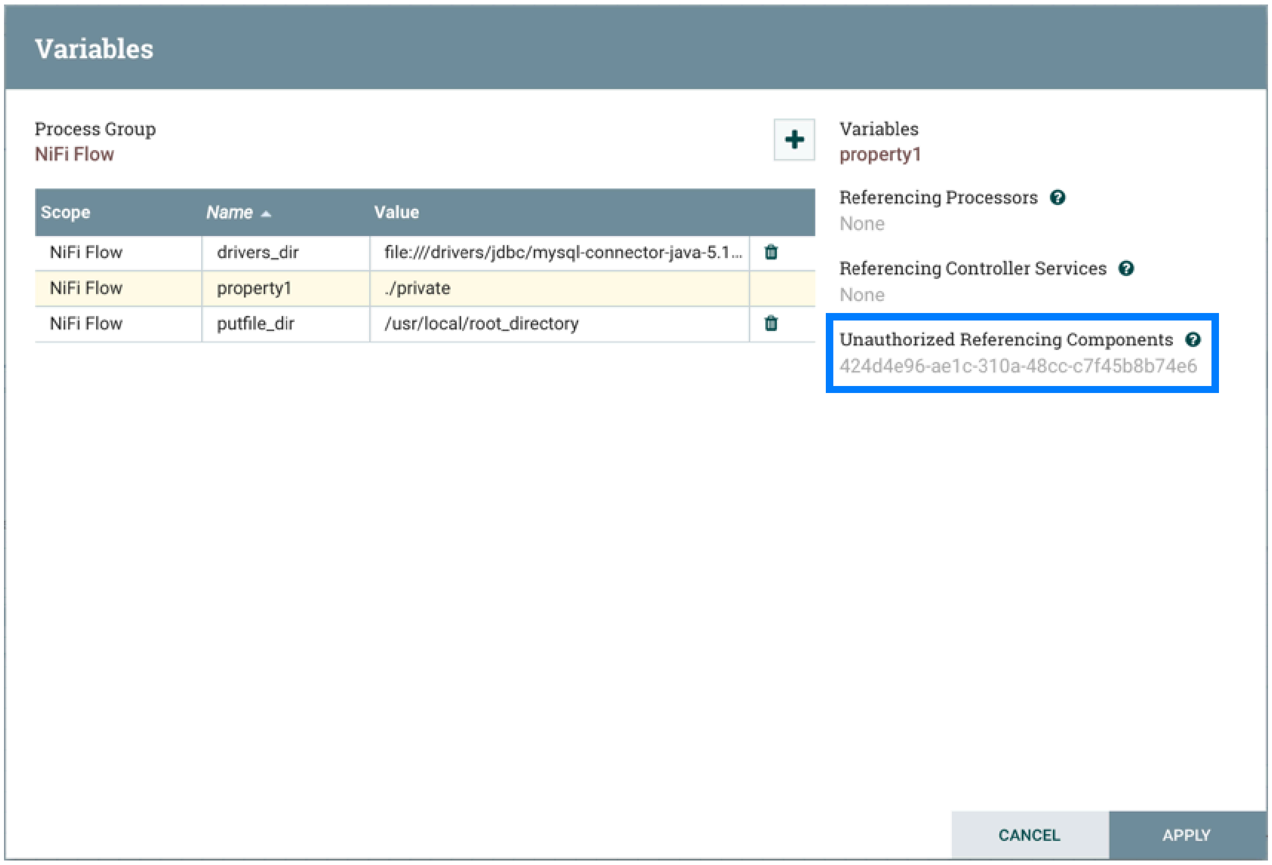
Name	Type	Bundle	State	Scope
DBCPConnectionPool	DBCPConnectionPool 1.4.0	org.apache.nifi - nifi-dbcp-service-nar	Enabled	NiFi Flow

Last updated: 12:08:48 EDT

Listed services are available to all descendant Processors and services of this Process Group.

Unauthorized Referencing Components

When View or Modify privileges are not given to a component that references a variable, the UUID of the component will be displayed in the Variables window:



Variables

Process Group
NiFi Flow

Scope	Name ▲	Value
NiFi Flow	drivers_dir	file:///drivers/jdbc/mysql-connector-java-5.1...
NiFi Flow	property1	./private
NiFi Flow	putfile_dir	/usr/local/root_directory

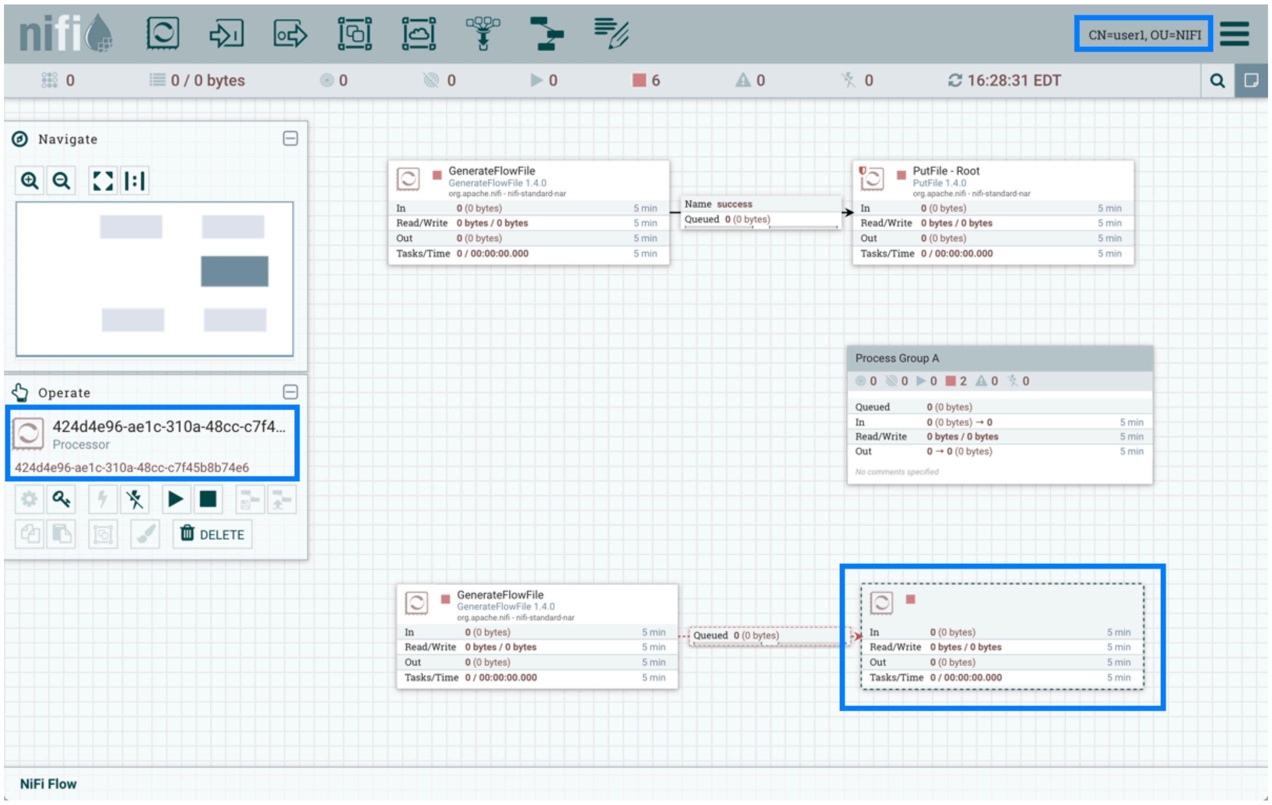
Variables
property1

Referencing Processors
None

Referencing Controller Services
None

Unauthorized Referencing Components
424d4e96-ae1c-310a-48cc-c7f45b8b74e6

In the above example, the variable property1 is referenced by a processor that "user1" is not able to view:



424d4e96-ae1c-310a-48cc-c7f4...
Processor
424d4e96-ae1c-310a-48cc-c7f45b8b74e6

GenerateFlowFile
GenerateFlowFile 1.4.0
org.apache.nifi - nifi-standard-nar

In	0 (0 bytes)	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 (0 bytes)	5 min
Tasks/Time	0 / 00:00:00.000	5 min

Name success
Queued 0 (0 bytes)

PutFile - Root
PutFile 1.4.0
org.apache.nifi - nifi-standard-nar

In	0 (0 bytes)	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 (0 bytes)	5 min
Tasks/Time	0 / 00:00:00.000	5 min

Process Group A
0 0 0 2 0 0

Queued	0 (0 bytes)	
In	0 (0 bytes) → 0	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 → 0 (0 bytes)	5 min

No comments specified

GenerateFlowFile
GenerateFlowFile 1.4.0
org.apache.nifi - nifi-standard-nar

In	0 (0 bytes)	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 (0 bytes)	5 min
Tasks/Time	0 / 00:00:00.000	5 min

Queued 0 (0 bytes)

In	0 (0 bytes)	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 (0 bytes)	5 min
Tasks/Time	0 / 00:00:00.000	5 min

Referencing Custom Properties via nifi.properties

Note: Custom properties via Variables and the nifi.properties file are still supported for compatibility purposes but do not have the same power as Parameters such as support for sensitive properties and more granular control over who can create, modify or use them. Variables and the nifi.variable.registry.properties property will be removed in a future release. As a result, it is highly recommended to switch to Parameters.

Identify one or more sets of key/value pairs, and give them to your system administrator.

Once the new custom properties have been added, ensure that the nifi.variable.registry.properties field in the nifi.properties file is updated with the custom properties location.

Note: NiFi must be restarted for these updates to be picked up.

For more information, see the Custom Properties section in the *System Administrator's Guide*.

Controller Services

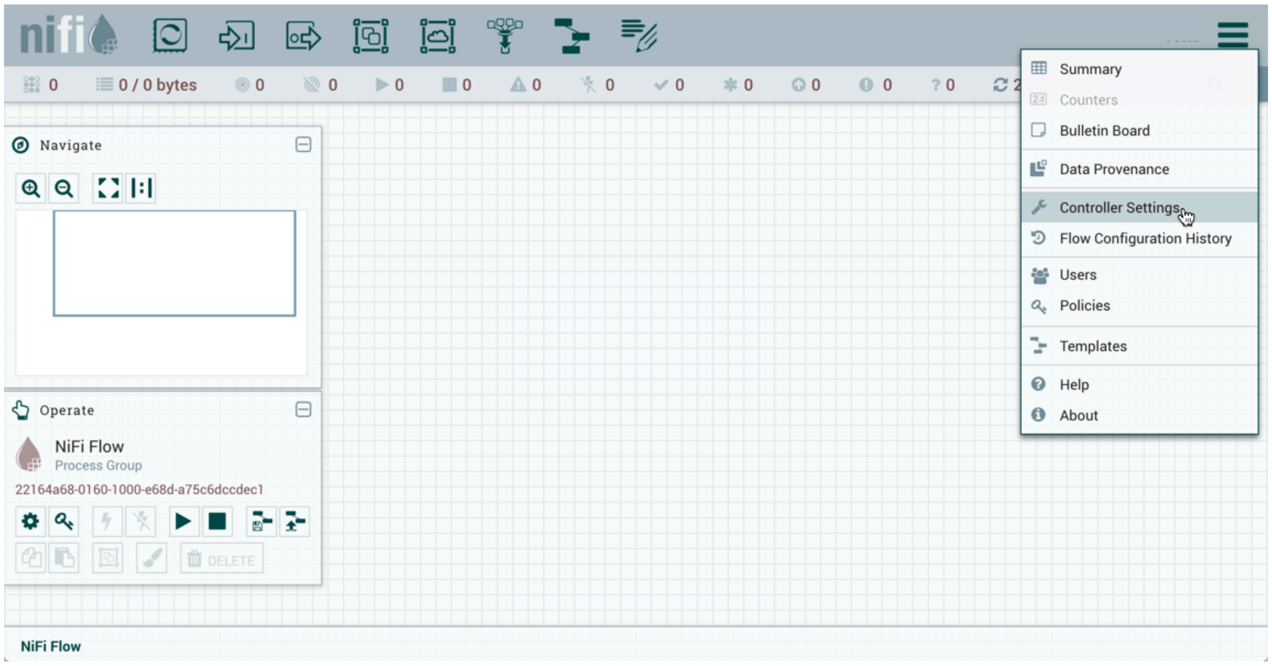
Controller Services are shared services that can be used by reporting tasks, processors, and other services to utilize for configuration or task execution.

Note: Controller Services defined on the controller level are limited to reporting tasks and other services defined there. Controller Services for use by processors in your dataflow must be defined in the configuration of the root process group or sub-process group(s) where they will be used.

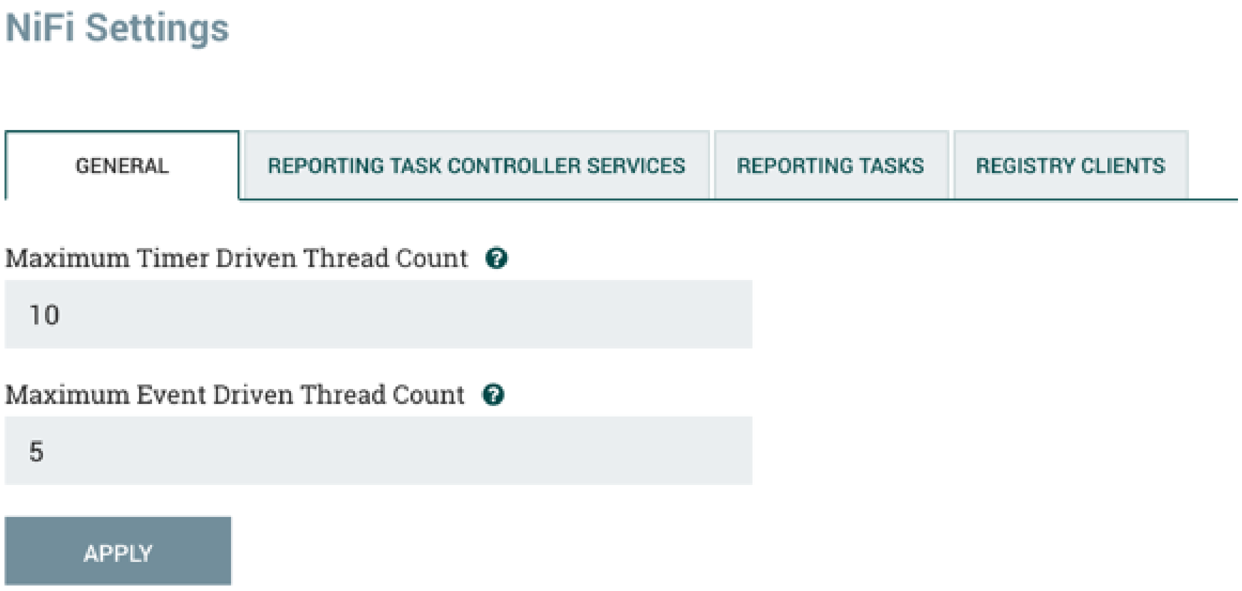
Note: If your NiFi instance is secured, your ability to view and add Controller Services is dependent on the privileges assigned to you. If you do not have access to one or more Controller Services, you are not able to see or access it in the UI. Access privileges can be assigned on a global or Controller Service-specific basis (see Accessing the UI with Multi-Tenant Authorization for more information).

Adding Controller Services for Reporting Tasks

To add a Controller Service for a reporting task, select Controller Settings from the Global Menu.



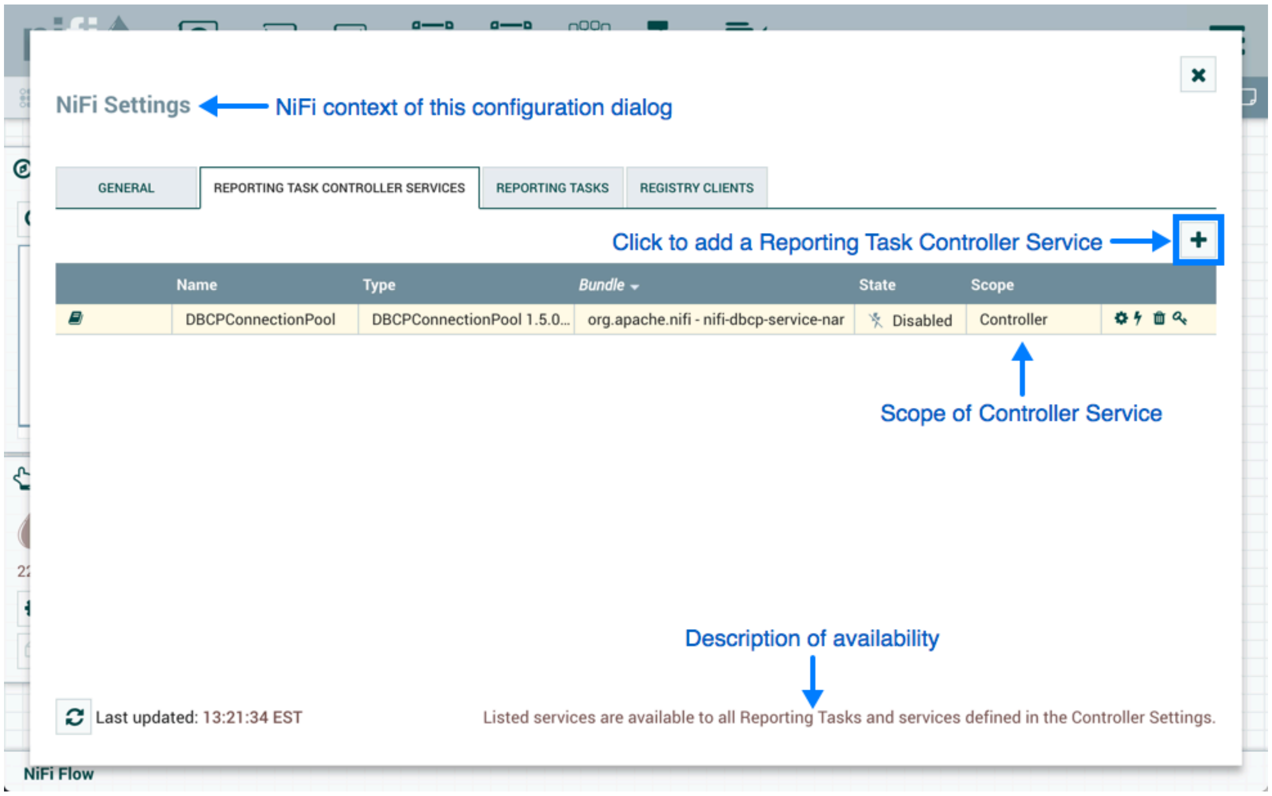
This displays the NiFi Settings window. The window has four tabs: General, Reporting Task Controller Services, Reporting Tasks and Registry Clients. The General tab provides settings for the overall maximum thread counts of the instance.



Maximum Timer Driven Thread Count: 10

Maximum Event Driven Thread Count: 5

To the right of the General tab is the Reporting Task Controller Services tab. From this tab, the DFM may click the + button in the upper-right corner to create a new Controller Service.

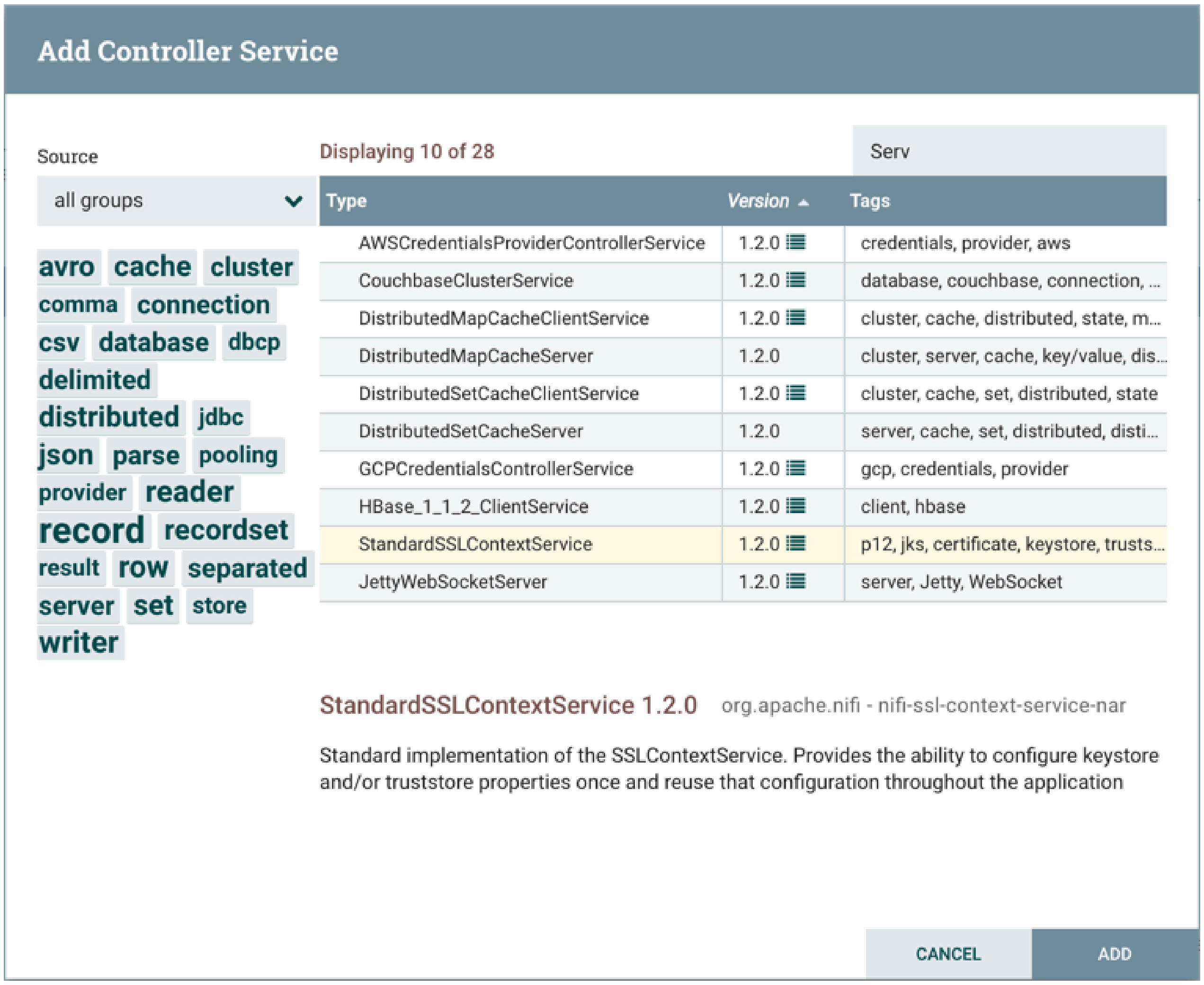

NiFi Settings
NiFi context of this configuration dialog
GENERAL
REPORTING TASK CONTROLLER SERVICES
REPORTING TASKS
REGISTRY CLIENTS
Click to add a Reporting Task Controller Service
Scope of Controller Service
Description of availability
NiFi Flow

Name	Type	Bundle	State	Scope
DBCPConnectionPool	DBCPConnectionPool 1.5.0...	org.apache.nifi - nifi-dbcp-service-nar	Disabled	Controller

Last updated: 13:21:34 EST

Listed services are available to all Reporting Tasks and services defined in the Controller Settings.

The Add Controller Service window opens. This window is similar to the Add Processor window. It provides a list of the available Controller Services on the right and a tag cloud, showing the most common category tags used for Controller Services, on the left. The DFM may click any tag in the tag cloud in order to narrow down the list of Controller Services to those that fit the categories desired. The DFM may also use the Filter field at the top-right of the window to search for the desired Controller Service or use the Source drop-down at the top-left to filter the list by the group who created them. Upon selecting a Controller Service from the list, the DFM can see a description of the service below. Select the desired controller service and click Add, or simply double-click the name of the service to add it.

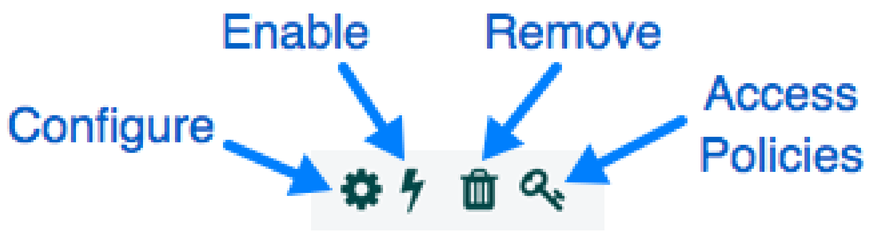

Add Controller Service
Source
all groups
avro cache cluster comma connection csv database dbcp delimited distributed jdbc json parse pooling provider reader record recordset result row separated server set store writer
Displaying 10 of 28
Serv
CANCEL
ADD

Type	Version	Tags
AWSCredentialsProviderControllerService	1.2.0	credentials, provider, aws
CouchbaseClusterService	1.2.0	database, couchbase, connection, ...
DistributedMapCacheClientService	1.2.0	cluster, cache, distributed, state, m...
DistributedMapCacheServer	1.2.0	cluster, server, cache, key/value, dis...
DistributedSetCacheClientService	1.2.0	cluster, cache, set, distributed, state
DistributedSetCacheServer	1.2.0	server, cache, set, distributed, disti...
GCPCredentialsControllerService	1.2.0	gcp, credentials, provider
HBase_1_1_2_ClientService	1.2.0	client, hbase
StandardSSLContextService	1.2.0	p12, jks, certificate, keystore, trusts...
JettyWebSocketServer	1.2.0	server, Jetty, WebSocket

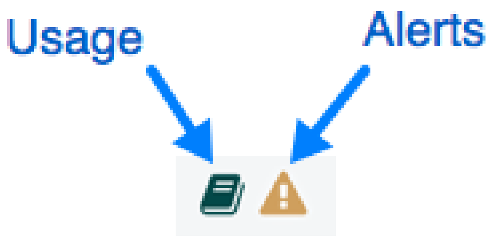
StandardSSLContextService 1.2.0 org.apache.nifi - nifi-ssl-context-service-nar

Standard implementation of the SSLContextService. Provides the ability to configure keystore and/or truststore properties once and reuse that configuration throughout the application

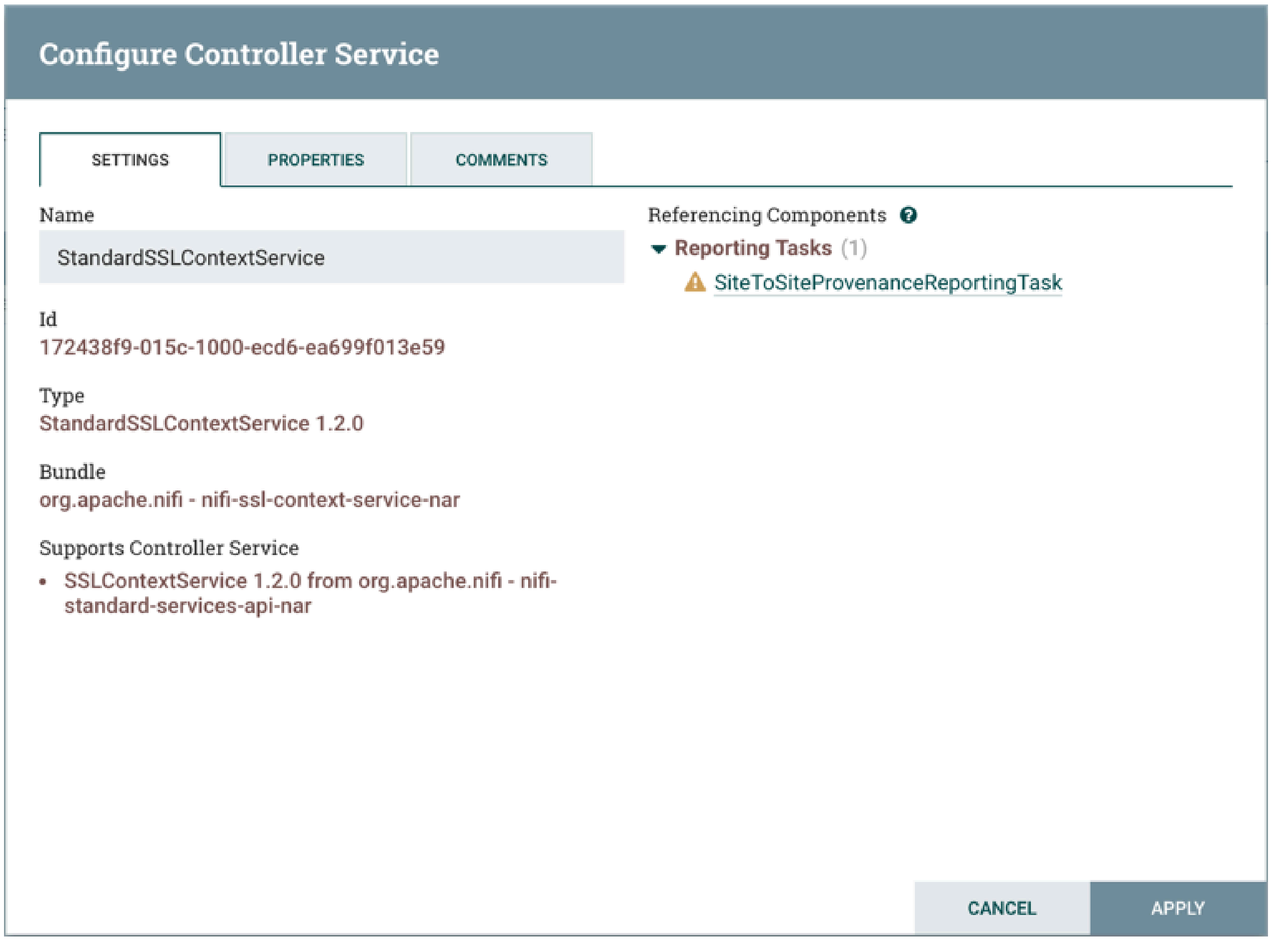
Once you have added a Controller Service, you can configure it by clicking the "Configure" button in the far-right column. Other buttons in this column include "Enable", "Remove" and "Access Policies".



You can obtain information about Controller Services by clicking the "Usage" and "Alerts" buttons in the left-hand column.



When the DFM clicks the "Configure" button, a Configure Controller Service window opens. It has three tabs: Settings, Properties,and Comments. This window is similar to the Configure Processor window. The Settings tab provides a place for the DFM to give the Controller Service a unique name (if desired). It also lists the UUID, Type, Bundle and Support information for the service and provides a list of other components (reporting tasks or other controller services) that reference the service.



Name
StandardSSLContextService

Id
172438f9-015c-1000-ecd6-ea699f013e59

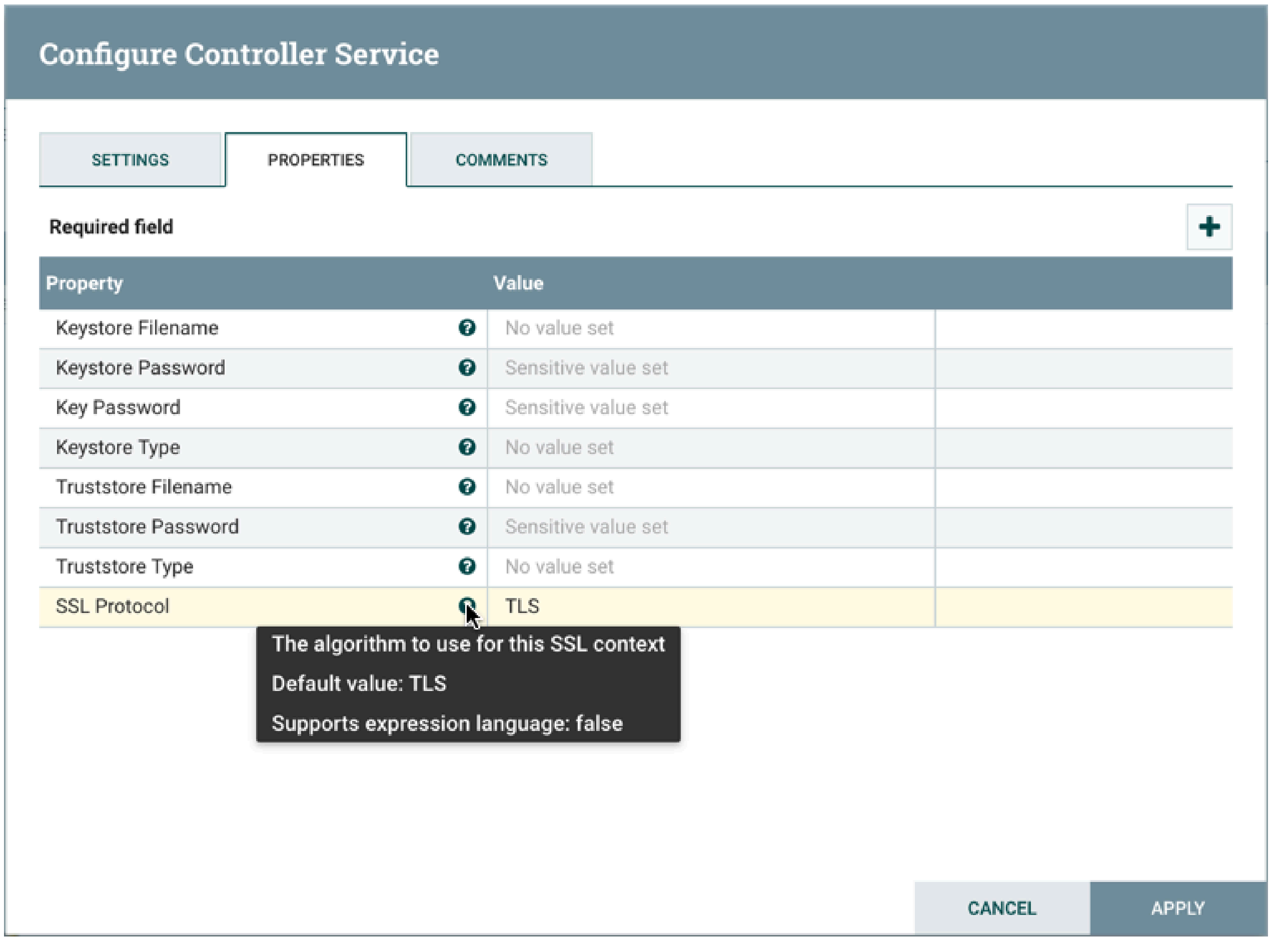
Type
StandardSSLContextService 1.2.0

Bundle
org.apache.nifi - nifi-ssl-context-service-nar

Supports Controller Service
- SSLContextService 1.2.0 from org.apache.nifi - nifi-standard-services-api-nar

Referencing Components
- Reporting Tasks (1)
  - SiteToSiteProvenanceReportingTask

The Properties tab lists the various properties that apply to the particular controller service. As with configuring processors, the DFM may hover over the question mark icons to see more information about each property.


Configure Controller Service

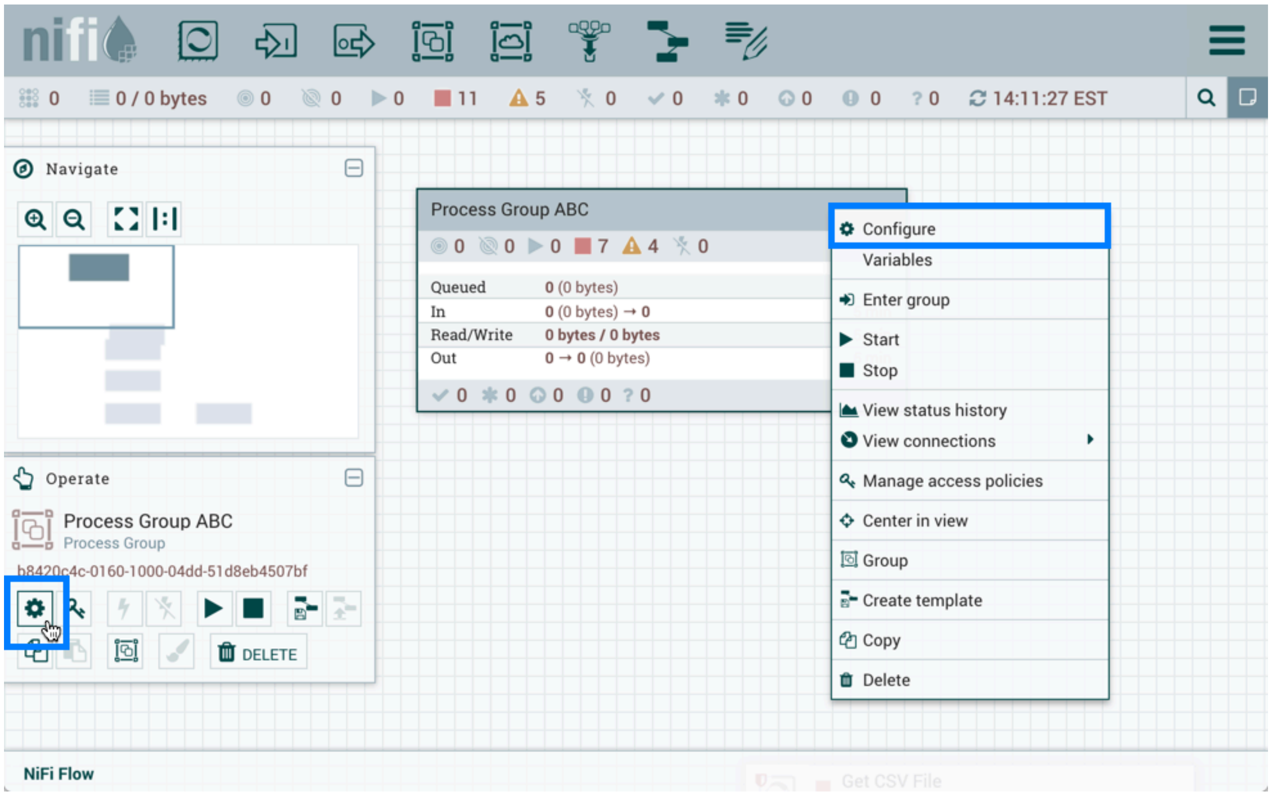
Property	Value
Keystore Filename	No value set
Keystore Password	Sensitive value set
Key Password	Sensitive value set
Keystore Type	No value set
Truststore Filename	No value set
Truststore Password	Sensitive value set
Truststore Type	No value set
SSL Protocol	TLS

The algorithm to use for this SSL context
Default value: TLS
Supports expression language: false

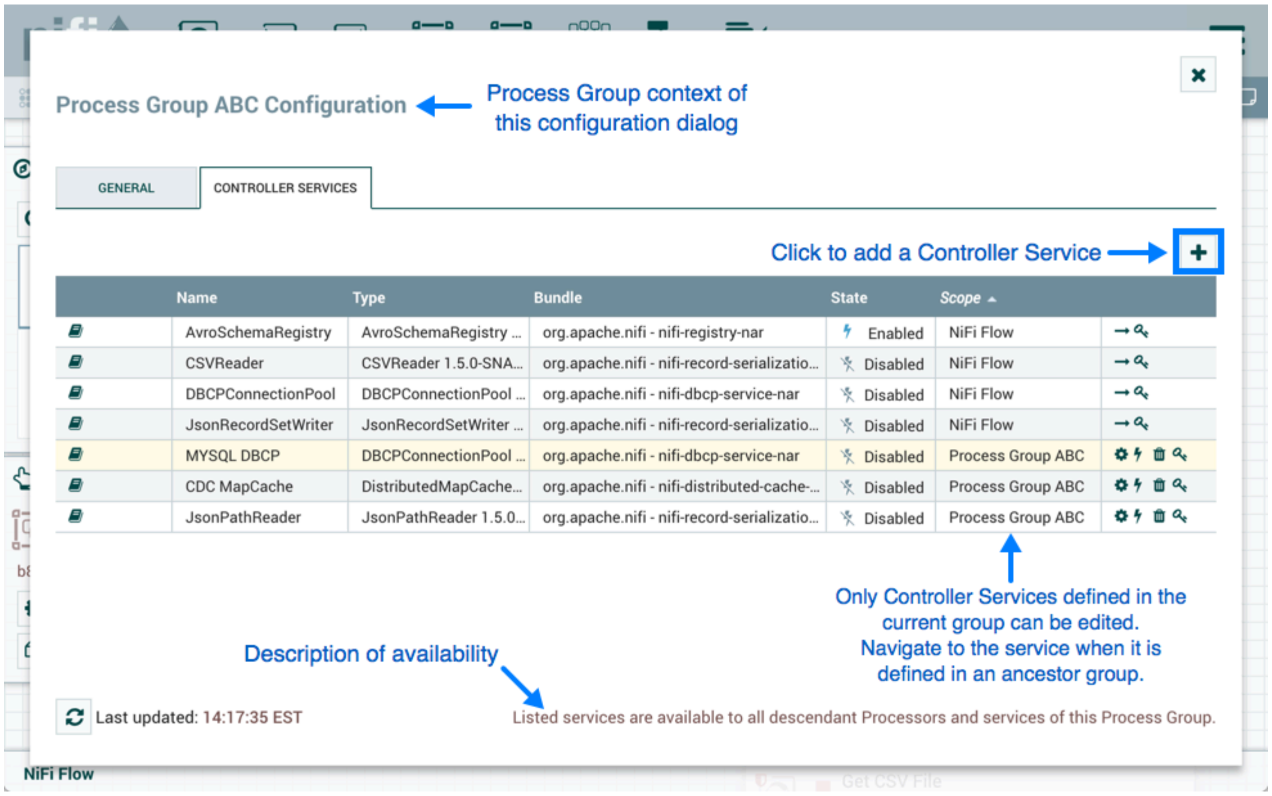
The Comments tab is just an open-text field, where the DFM may include comments about the service. After configuring a Controller Service, click "Apply" to save the configuration and close the window, or click "Cancel" to discard the changes and close the window.

Adding Controller Services for Dataflows

To add a Controller Service for a dataflow, you can either right click a Process Group and select Configure, or click Configure from the Operate Palette.



When you click Configure from the Operate Palette with nothing selected on your canvas, you add a Controller Service for your Root Process Group. That Controller Service is then available to all nested Process Groups in your dataflow. When you select a Process Group on the canvas and then click Configure from either the Operate Palette or the Process Group context menu, the service will be available to all Processors and Controller Services defined in that Process Group and below.

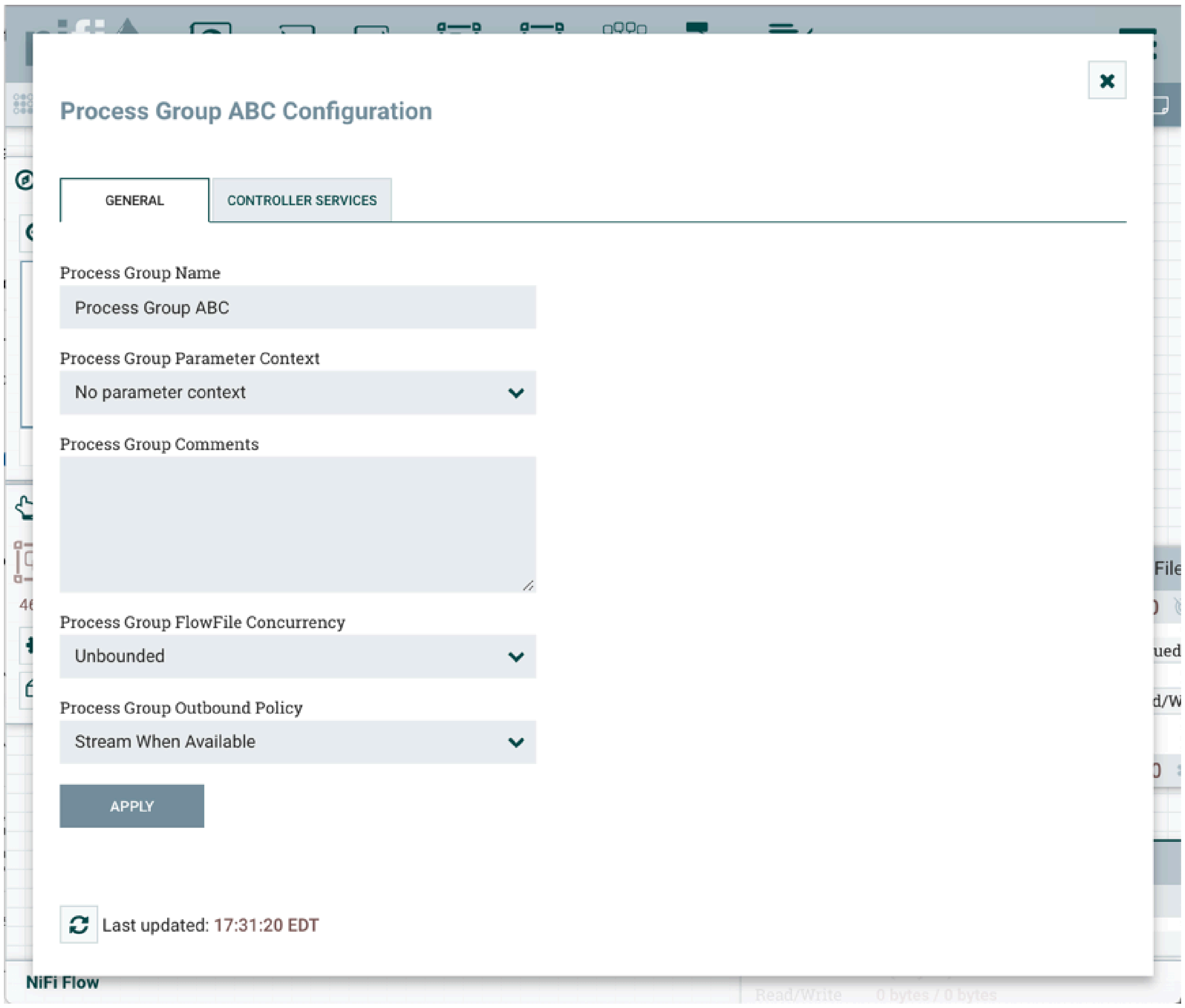

Process Group ABC Configuration
Process Group context of this configuration dialog
GENERAL
CONTROLLER SERVICES
Click to add a Controller Service
Only Controller Services defined in the current group can be edited. Navigate to the service when it is defined in an ancestor group.
Description of availability
Last updated: 14:17:35 EST
NiFi Flow

Name	Type	Bundle	State	Scope
AvroSchemaRegistry	AvroSchemaRegistry ...	org.apache.nifi - nifi-registry-nar	Enabled	NiFi Flow
CSVReader	CSVReader 1.5.0-SNA...	org.apache.nifi - nifi-record-serializatio...	Disabled	NiFi Flow
DBCPConnectionPool	DBCPConnectionPool ...	org.apache.nifi - nifi-dbcp-service-nar	Disabled	NiFi Flow
JsonRecordSetWriter	JsonRecordSetWriter ...	org.apache.nifi - nifi-record-serializatio...	Disabled	NiFi Flow
MYSQL DBCP	DBCPConnectionPool ...	org.apache.nifi - nifi-dbcp-service-nar	Disabled	Process Group ABC
CDC MapCache	DistributedMapCache...	org.apache.nifi - nifi-distributed-cache-...	Disabled	Process Group ABC
JsonPathReader	JsonPathReader 1.5.0...	org.apache.nifi - nifi-record-serializatio...	Disabled	Process Group ABC

Listed services are available to all descendant Processors and services of this Process Group.

Use the following steps to add a Controller Service:

1. Click Configure, either from the Operate Palette, or from the Process Group context menu. This displays the process group Configuration window. The window has two tabs: General and Controller Services. The 70117906cdaf545fa108bc7ddb3ce5dc88e404c7.html#General_tab_ProcessGroup is for settings that pertain to general information about the process group.


Process Group ABC Configuration

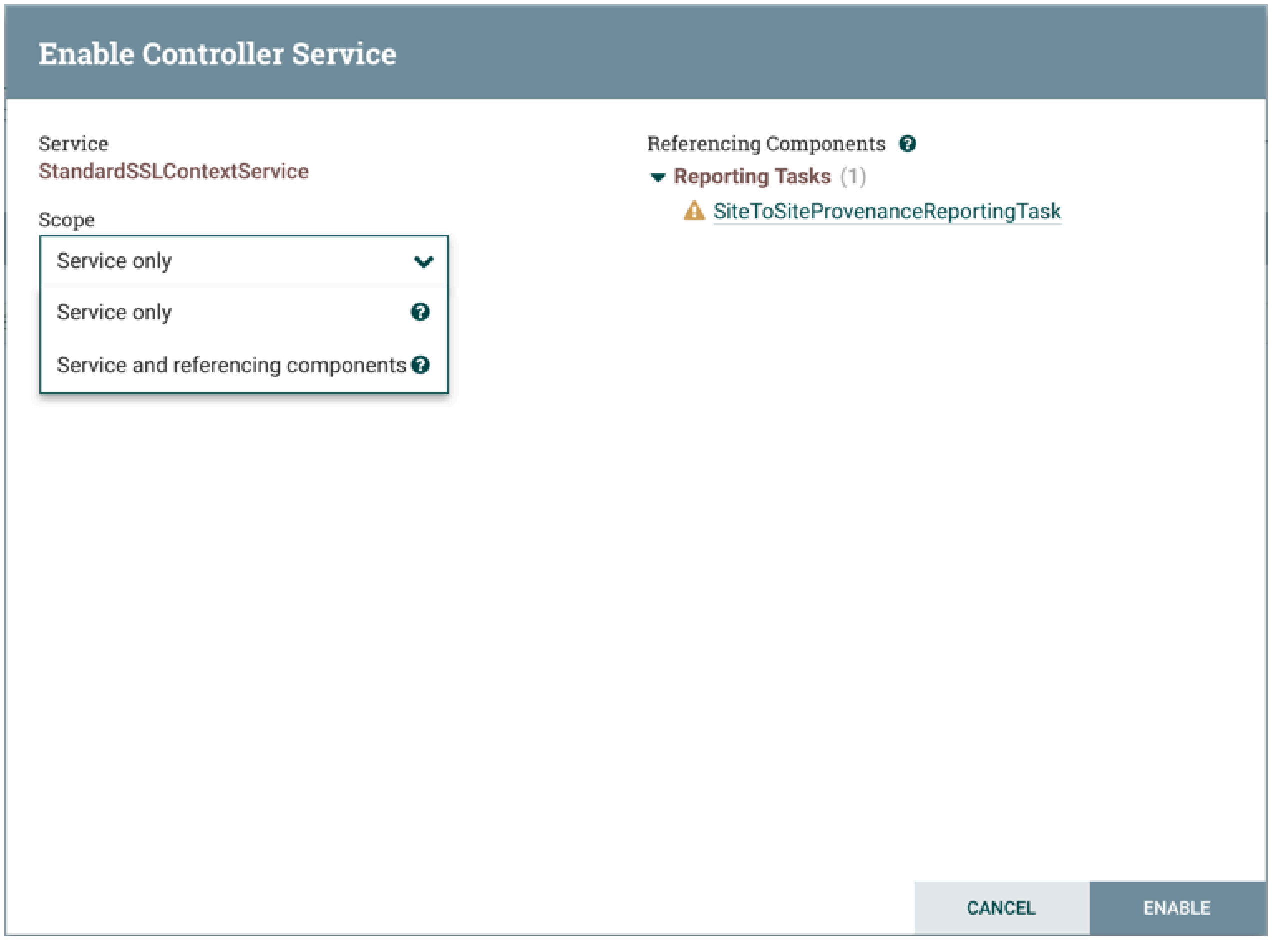
Process Group Name: Process Group ABC
Process Group Parameter Context: No parameter context
Process Group Comments:
Process Group FlowFile Concurrency: Unbounded
Process Group Outbound Policy: Stream When Available

Last updated: 17:31:20 EDT

2. From the Process Group Configuration page, select the Controller Services tab.
3. Click the + button to display the Add Controller Service dialog.
4. Select the Controller Service desired, and click Add.
5. Perform any necessary Controller Service configuration tasks by clicking the Configure icon ( ) in the right-hand column.

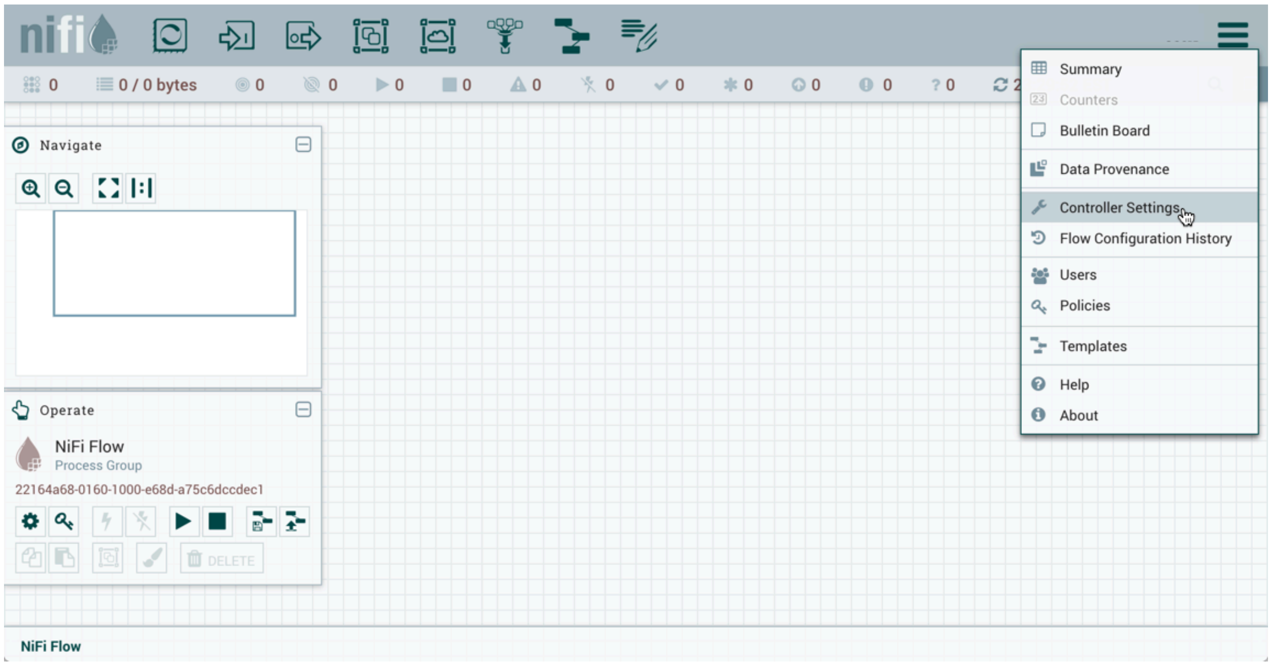
Enabling/Disabling Controller Services

After a Controller Service has been configured, it must be enabled in order to run. Do this using the "Enable" button ( ) in the far-right column of the Controller Services tab. In order to modify an existing/running controller service, the DFM needs to stop/disable it (as well as all referencing reporting tasks and controller services). Do this using the "Disable" button ( ). Rather than having to hunt down each component that is referenced by that controller service, the DFM has the ability to stop/disable them when disabling the controller service in question. When enabling a controller service, the DFM has the option to either start/enable the controller service and all referencing components or start/enable only the controller service itself.

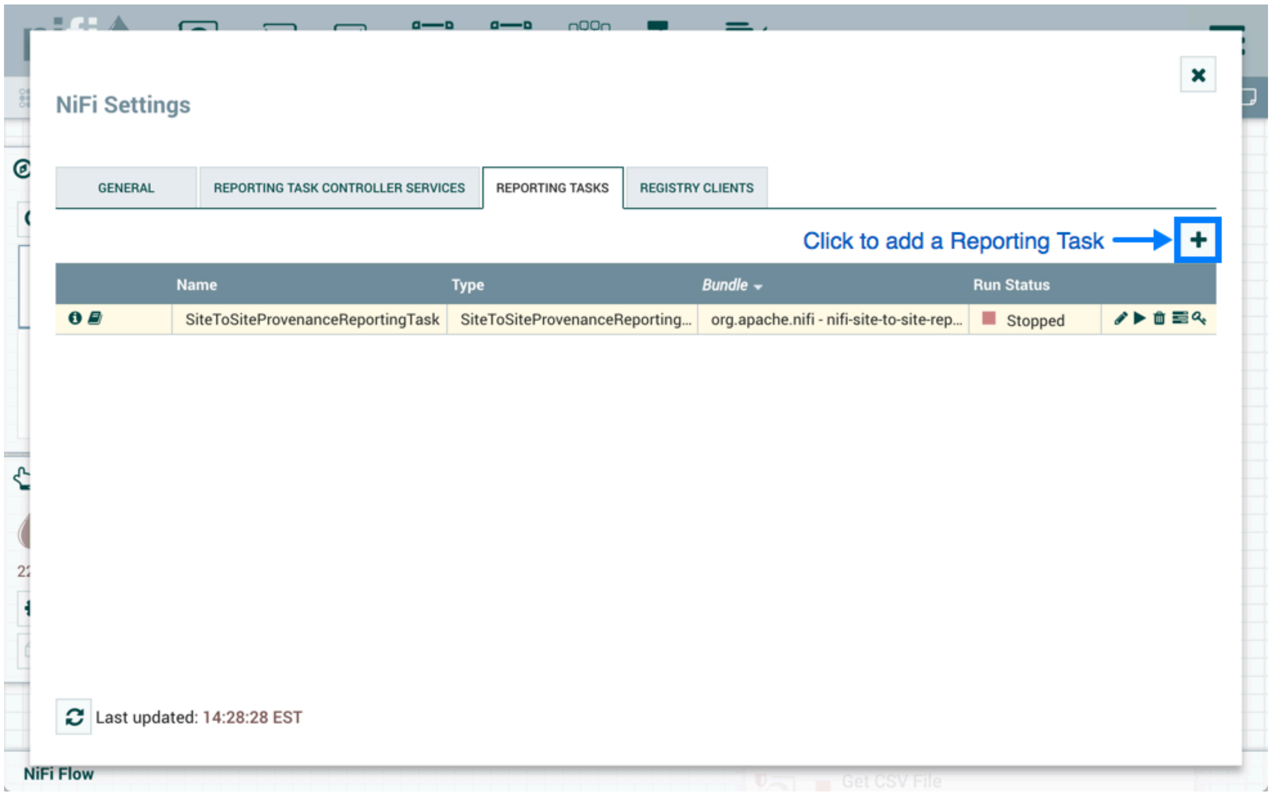

Enable Controller Service
Service
StandardSSLContextService
Scope
Service only
Service only
Service and referencing components
Referencing Components
Reporting Tasks (1)
SiteToSiteProvenanceReportingTask
CANCEL
ENABLE

Reporting Tasks

Reporting Tasks run in the background to provide statistical reports about what is happening in the NiFi instance. The DFM adds and configures Reporting Tasks similar to the process for Controller Services. To add a Reporting Task, select Controller Settings from the Global Menu.

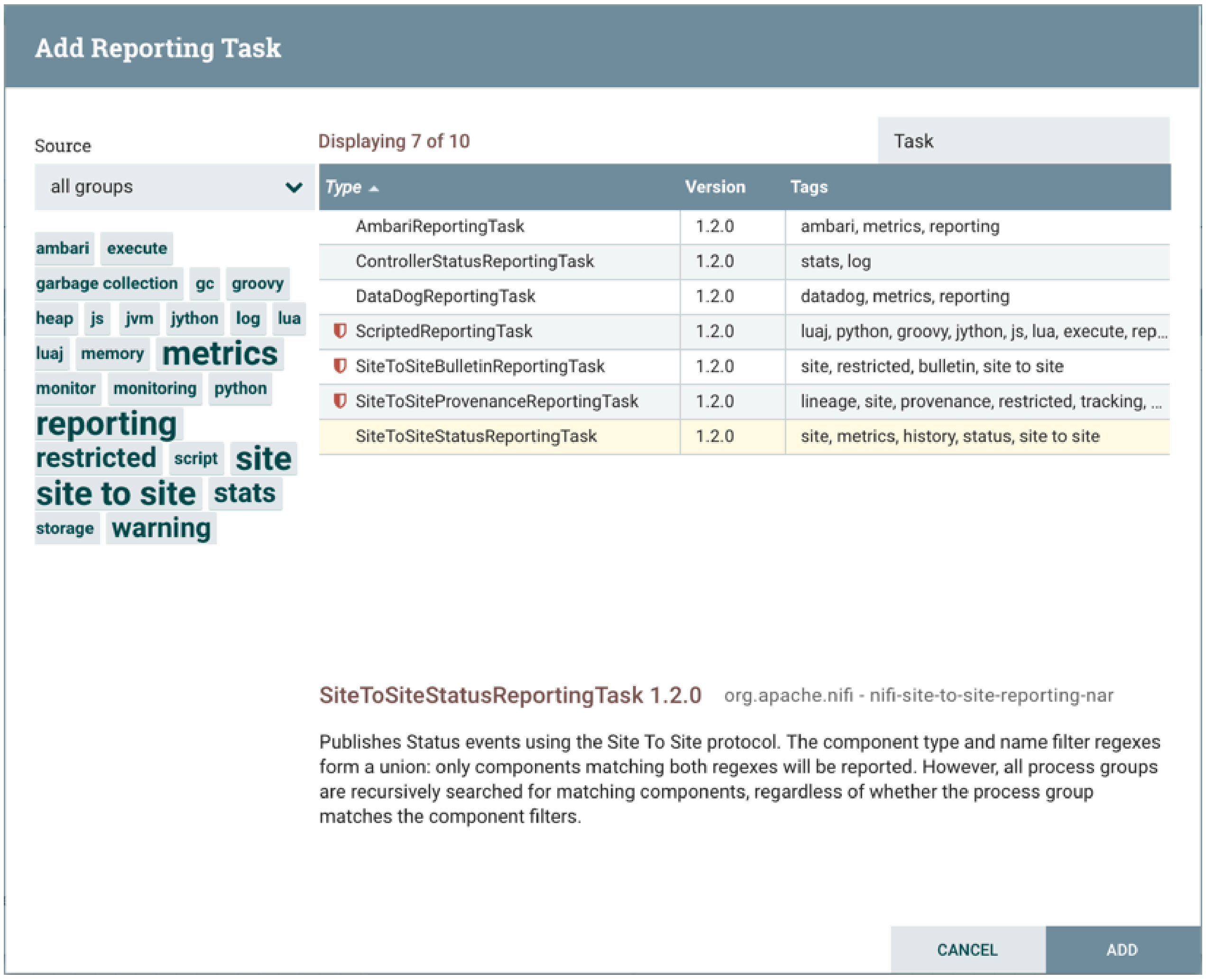


This displays the NiFi Settings window. Select the Reporting Tasks tab and click the + button in the upper-right corner to create a new Reporting Task.


NiFi Settings
GENERAL
REPORTING TASK CONTROLLER SERVICES
REPORTING TASKS
REGISTRY CLIENTS
Click to add a Reporting Task
Last updated: 14:28:28 EST
NiFi Flow

Name	Type	Bundle	Run Status
SiteToSiteProvenanceReportingTask	SiteToSiteProvenanceReporting...	org.apache.nifi - nifi-site-to-site-rep...	Stopped

The Add Reporting Task window opens. This window is similar to the Add Processor window. It provides a list of the available Reporting Tasks on the right and a tag cloud, showing the most common category tags used for Reporting Tasks, on the left. The DFM may click any tag in the tag cloud in order to narrow down the list of Reporting Tasks to those that fit the categories desired. The DFM may also use the Filter field at the top-right of the window to search for the desired Reporting Task or use the Source drop-down at the top-left to filter the list by the group who created them. Upon selecting a Reporting Task from the list, the DFM can see a description of the task below. Select the desired reporting task and click Add, or simply double-click the name of the service to add it.


Add Reporting Task

Source: all groups

ambari execute garbage collection gc groovy heap js jvm jython log lua luaj memory metrics monitor monitoring python reporting restricted script site site to site stats storage warning

Displaying 7 of 10 — Task

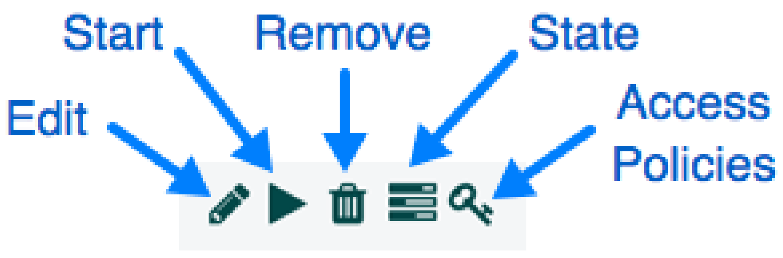
Type	Version	Tags
AmbariReportingTask	1.2.0	ambari, metrics, reporting
ControllerStatusReportingTask	1.2.0	stats, log
DataDogReportingTask	1.2.0	datadog, metrics, reporting
ScriptedReportingTask	1.2.0	luaj, python, groovy, jython, js, lua, execute, rep...
SiteToSiteBulletinReportingTask	1.2.0	site, restricted, bulletin, site to site
SiteToSiteProvenanceReportingTask	1.2.0	lineage, site, provenance, restricted, tracking, ...
SiteToSiteStatusReportingTask	1.2.0	site, metrics, history, status, site to site

SiteToSiteStatusReportingTask 1.2.0 org.apache.nifi - nifi-site-to-site-reporting-nar

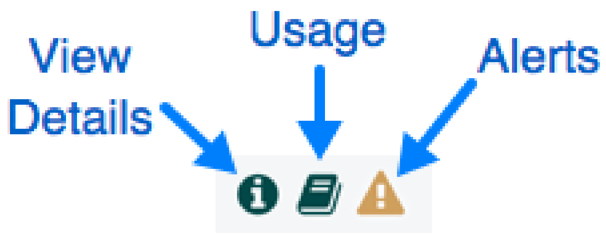
Publishes Status events using the Site To Site protocol. The component type and name filter regexes form a union: only components matching both regexes will be reported. However, all process groups are recursively searched for matching components, regardless of whether the process group matches the component filters.

CANCEL ADD

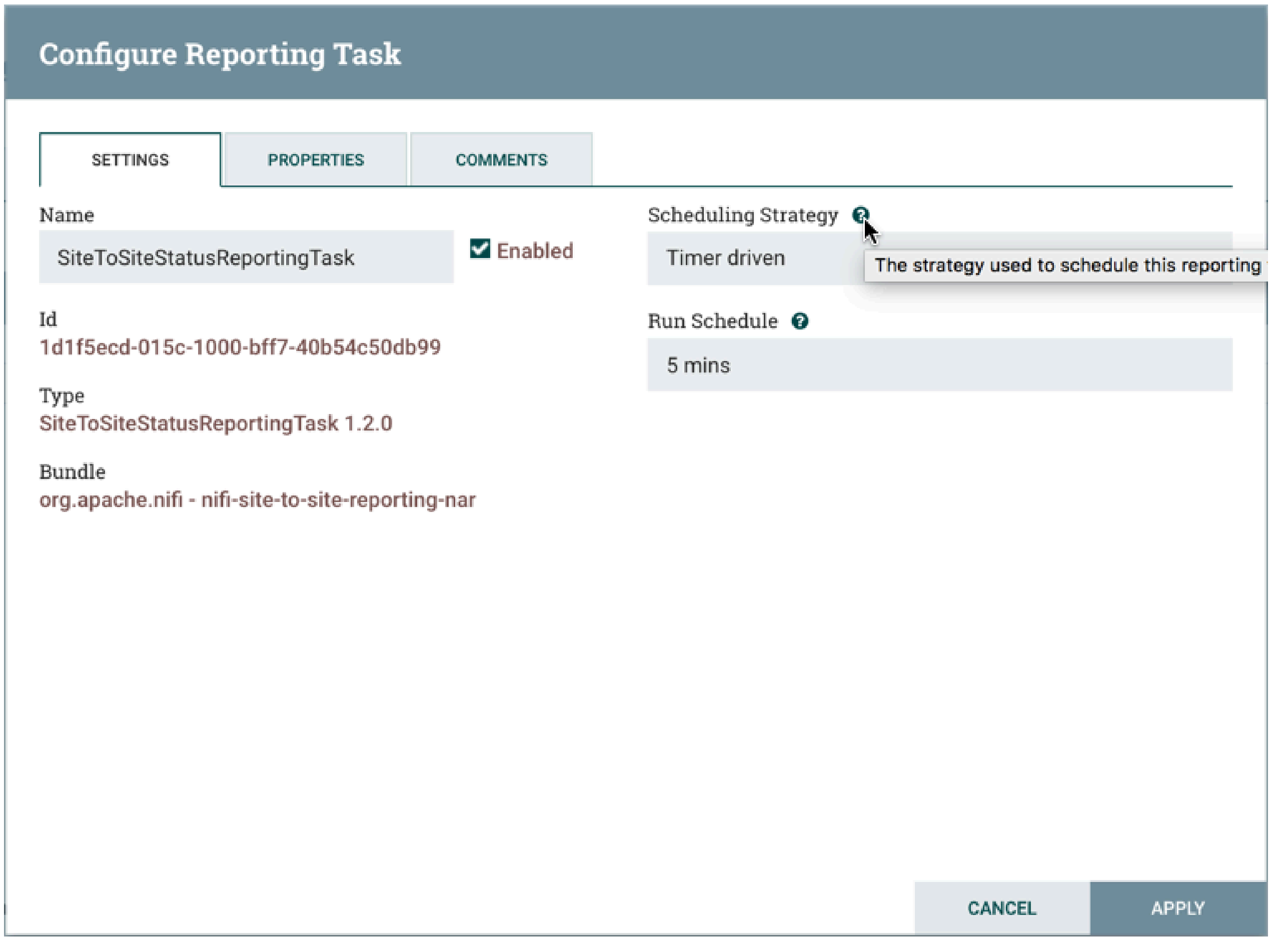
Once a Reporting Task has been added, the DFM may configure it by clicking the "Edit" button in the far-right column. Other buttons in this column include "Start", "Remove", "State" and "Access Policies".



You can obtain information about Reporting Tasks by clicking the "View Details", "Usage", and "Alerts" buttons in the left-hand column.



When the DFM clicks the "Edit" button, a Configure Reporting Task window opens. It has three tabs: Settings, Properties, and Comments. This window is similar to the Configure Processor window. The Settings tab provides a place for the DFM to give the Reporting Task a unique name (if desired). It also lists the UUID, Type, and Bundle information for the task and provides settings for the task's Scheduling Strategy and Run Schedule (similar to the same settings in a processor). The DFM may hover the mouse over the question mark icons to see more information about each setting.



Name
SiteToSiteStatusReportingTask
✓ Enabled

Scheduling Strategy
Timer driven
The strategy used to schedule this reporting

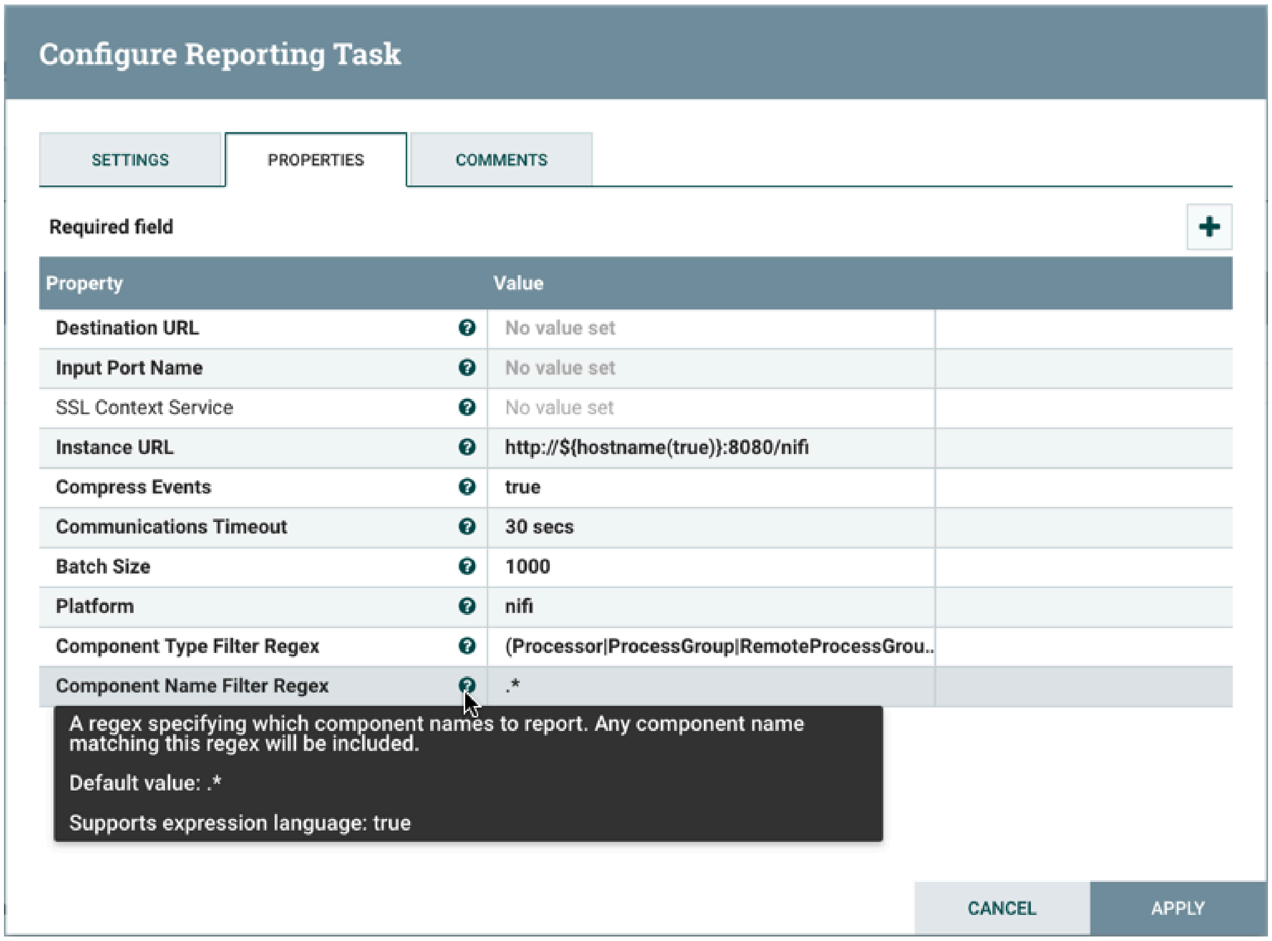
Id
1d1f5ecd-015c-1000-bff7-40b54c50db99

Run Schedule
5 mins

Type
SiteToSiteStatusReportingTask 1.2.0

Bundle
org.apache.nifi - nifi-site-to-site-reporting-nar

The Properties tab lists the various properties that may be configured for the task. The DFM may hover the mouse over the question mark icons to see more information about each property.



Required field

Property	Value
Destination URL	No value set
Input Port Name	No value set
SSL Context Service	No value set
Instance URL	http://${hostname(true)}:8080/nifi
Compress Events	true
Communications Timeout	30 secs
Batch Size	1000
Platform	nifi
Component Type Filter Regex	(Processor|ProcessGroup|RemoteProcessGrou..
Component Name Filter Regex	.*

A regex specifying which component names to report. Any component name matching this regex will be included.

Default value: .*

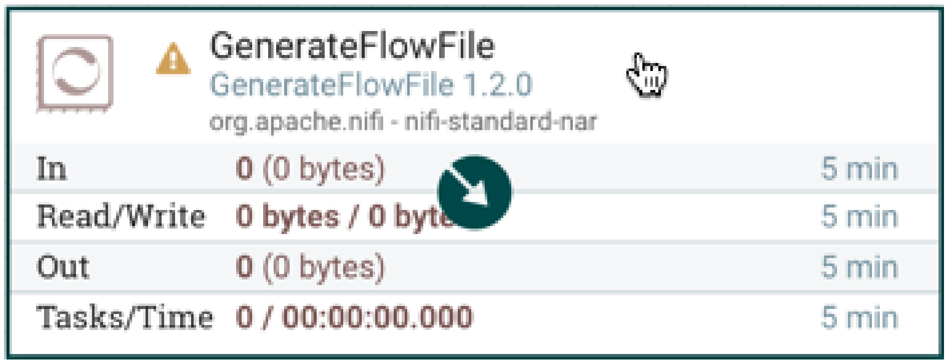
Supports expression language: true

The Comments tab is just an open-text field, where the DFM may include comments about the task. After configuring the Reporting Task, click "Apply" to save the configuration and close the window, or click "Cancel" to discard the changes and close the window.

When you want to run the Reporting Task, click the "Start" button (▶).

Connecting Components

Once processors and other components have been added to the canvas and configured, the next step is to connect them to one another so that NiFi knows what to do with each FlowFile after it has been processed. This is accomplished by creating a Connection between each component. When the user hovers the mouse over the center of a component, a new Connection icon (➘) appears:

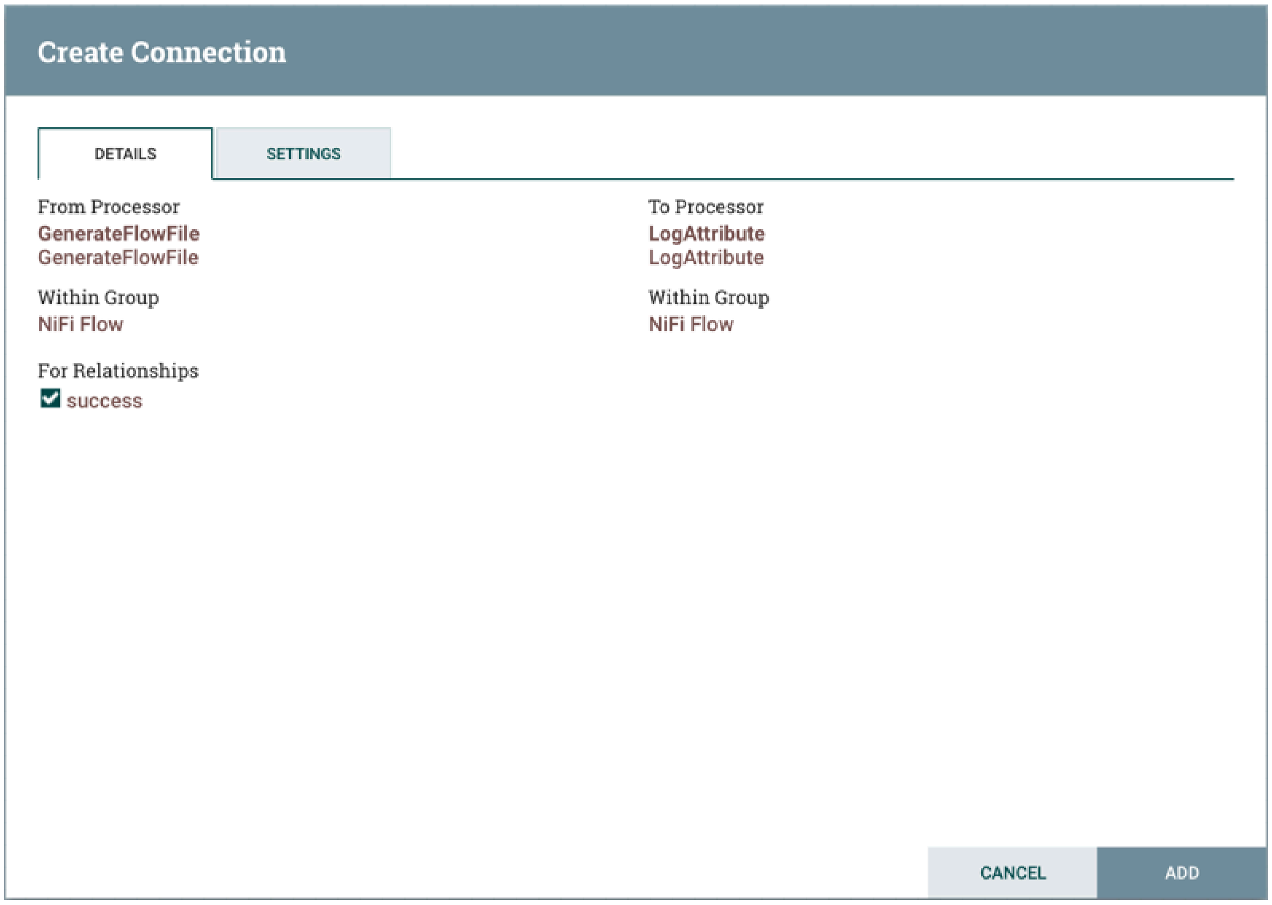


In	0 (0 bytes)	5 min
Read/Write	0 bytes / 0 byte	5 min
Out	0 (0 bytes)	5 min
Tasks/Time	0 / 00:00:00.000	5 min

The user drags the Connection bubble from one component to another until the second component is highlighted. When the user releases the mouse, a 'Create Connection' dialog appears. This dialog consists of two tabs: 'Details' and 'Settings'. They are discussed in detail below. Note that it is possible to draw a connection so that it loops back on the same processor. This can be useful if the DFM wants the processor to try to re-process FlowFiles if they go down a failure Relationship. To create this type of looping connection, simply drag the connection bubble away and then back to the same processor until it is highlighted. Then release the mouse and the same 'Create Connection' dialog appears.

Details Tab

The Details tab of the 'Create Connection' dialog provides information about the source and destination components, including the component name, the component type, and the Process Group in which the component lives:



From Processor
GenerateFlowFile
GenerateFlowFile

Within Group
NiFi Flow

For Relationships
✓ success

To Processor
LogAttribute
LogAttribute

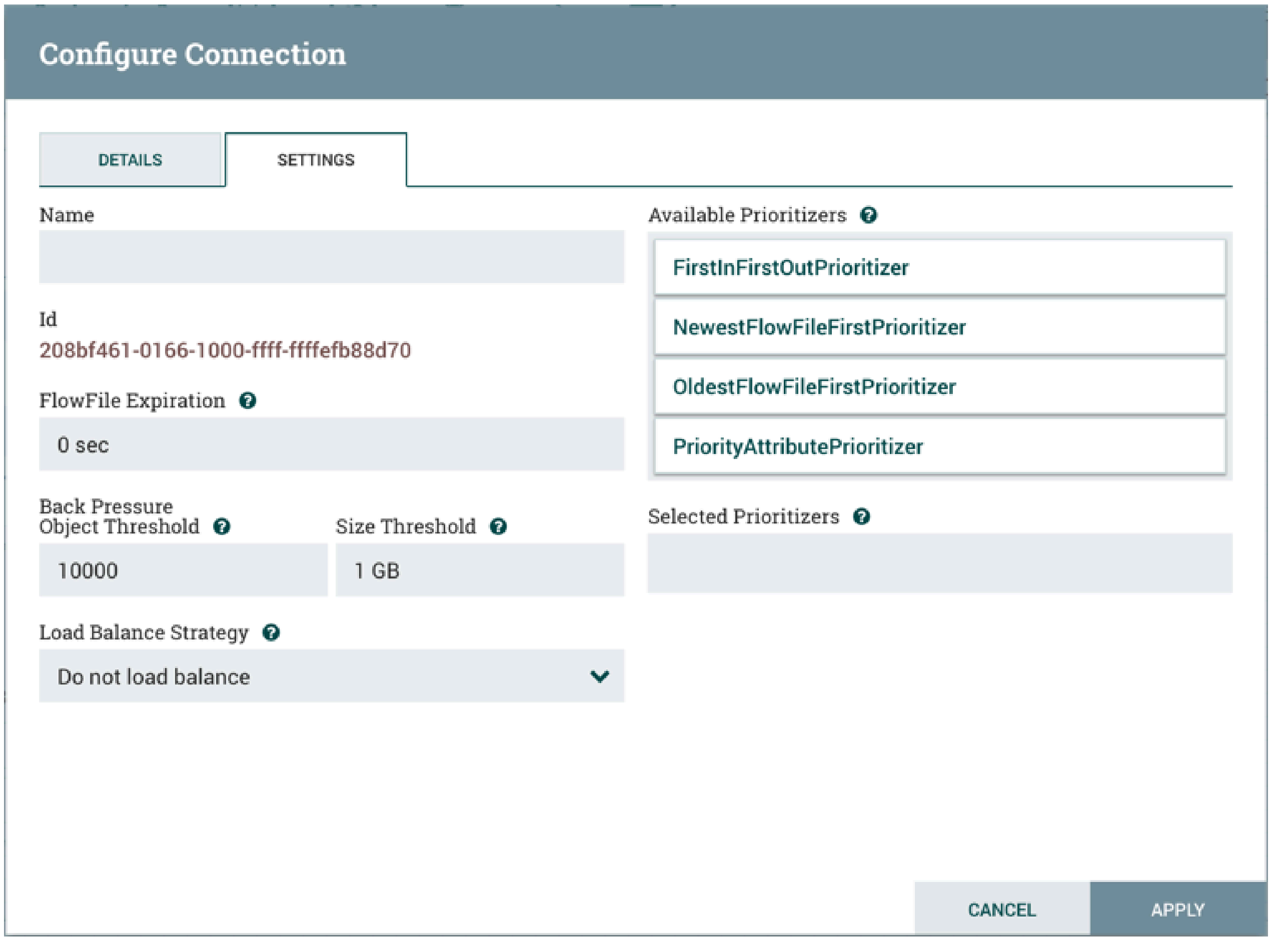
Within Group
NiFi Flow

Additionally, this tab provides the ability to choose which Relationships should be included in this Connection. At least one Relationship must be selected. If only one Relationship is available, it is automatically selected.

Note: If multiple Connections are added with the same Relationship, any FlowFile that is routed to that Relationship will automatically be 'cloned', and a copy will be sent to each of those Connections.

Settings

The Settings tab provides the ability to configure the Connection's Name, FlowFile Expiration, Back Pressure Thresholds, Load Balance Strategy and Prioritization:



Name

Id
208bf461-0166-1000-ffff-ffffefb88d70

FlowFile Expiration
0 sec

Back Pressure Object Threshold
10000

Size Threshold
1 GB

Load Balance Strategy
Do not load balance

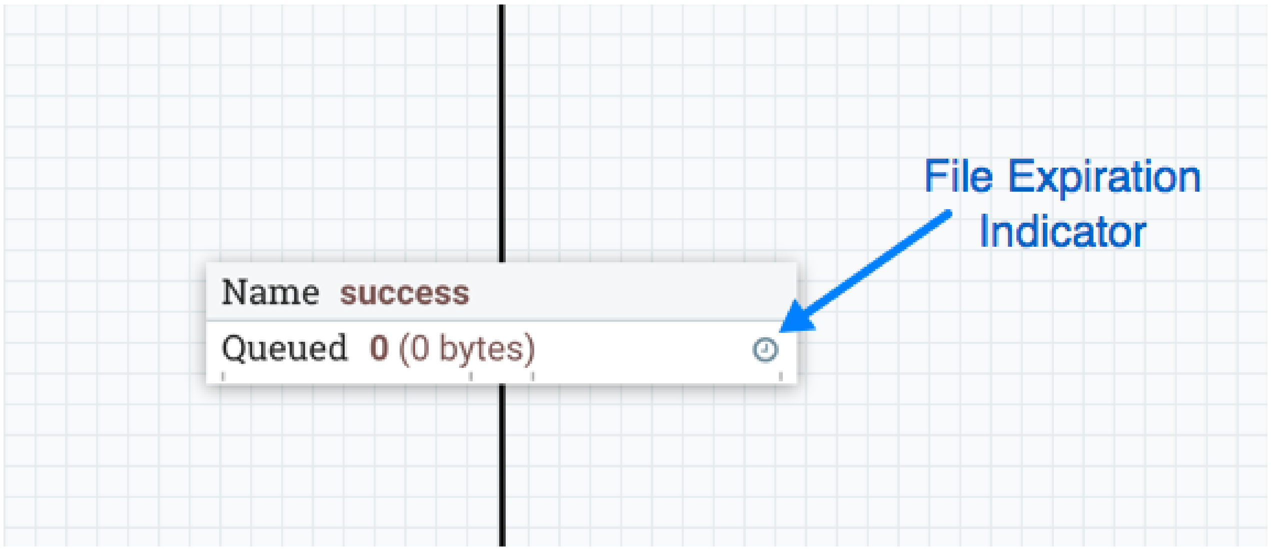
Available Prioritizers
FirstInFirstOutPrioritizer
NewestFlowFileFirstPrioritizer
OldestFlowFileFirstPrioritizer
PriorityAttributePrioritizer

Selected Prioritizers

The Connection name is optional. If not specified, the name shown for the Connection will be names of the Relationships that are active for the Connection.

FlowFile Expiration

FlowFile expiration is a concept by which data that cannot be processed in a timely fashion can be automatically removed from the flow. This is useful, for example, when the volume of data is expected to exceed the volume that can be sent to a remote site. In this case, the expiration can be used in conjunction with Prioritizers to ensure that the highest priority data is processed first and then anything that cannot be processed within a certain time period (one hour, for example) can be dropped. The expiration period is based on the time that the data entered the NiFi instance. In other words, if the file expiration on a given connection is set to '1 hour', and a file that has been in the NiFi instance for one hour reaches that connection, it will expire. The default value of 0 sec indicates that the data will never expire. When a file expiration other than '0 sec' is set, a small clock icon appears on the connection label, so the DFM can see it at-a-glance when looking at a flow on the canvas.

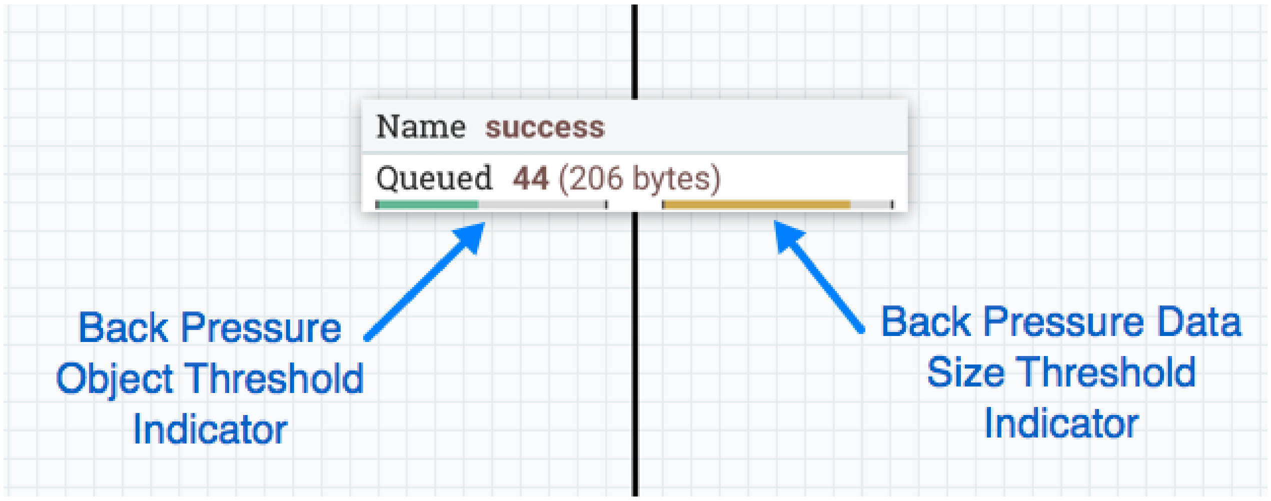


Back Pressure

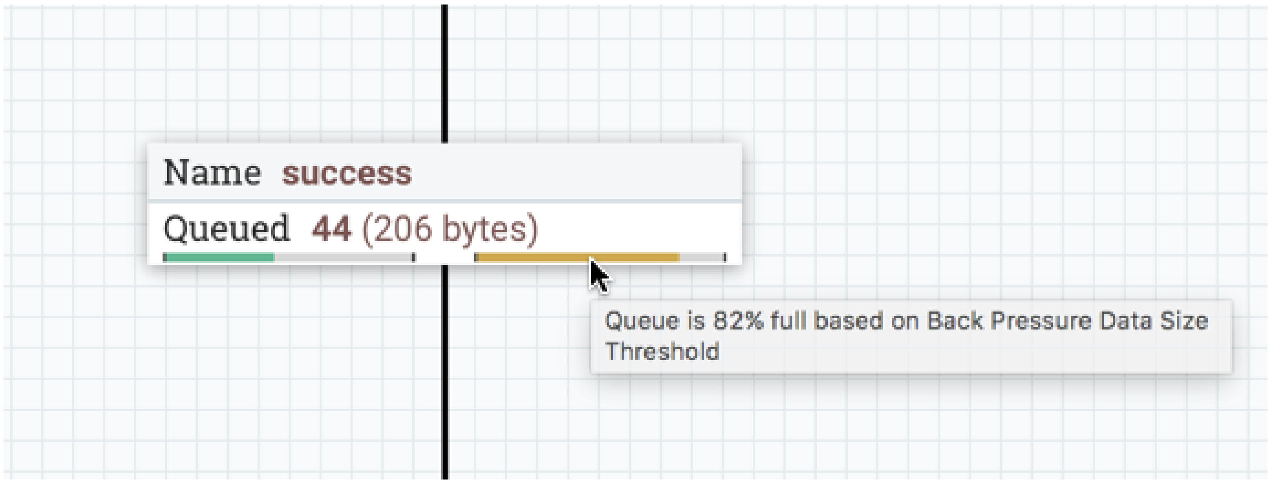
NiFi provides two configuration elements for Back Pressure. These thresholds indicate how much data should be allowed to exist in the queue before the component that is the source of the Connection is no longer scheduled to run. This allows the system to avoid being overrun with data. The first option provided is the "Back pressure object threshold." This is the number of FlowFiles that can be in the queue before back pressure is applied. The second configuration option is the "Back pressure data size threshold." This specifies the maximum amount of data (in size) that should be queued up before applying back pressure. This value is configured by entering a number followed by a data size (B for bytes, KB for kilobytes, MB for megabytes, GB for gigabytes, or TB for terabytes).

Note: By default each new connection added will have a default Back Pressure Object Threshold of 10,000 objects and Back Pressure Data Size Threshold of 1 GB. These defaults can be changed by modifying the appropriate properties in the nifi.properties file.

When back pressure is enabled, small progress bars appear on the connection label, so the DFM can see it at-a-glance when looking at a flow on the canvas. The progress bars change color based on the queue percentage: Green (0-60%), Yellow (61-85%) and Red (86-100%).

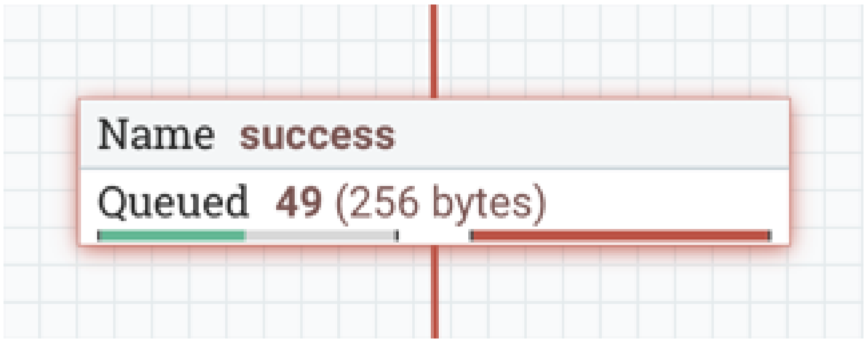

Name success
Queued 44 (206 bytes)
Back Pressure Object Threshold Indicator
Back Pressure Data Size Threshold Indicator

Hovering your mouse over a bar displays the exact percentage.



Queue is 82% full based on Back Pressure Data Size Threshold

When the queue is completely full, the Connection is highlighted in red.



Load Balancing

Load Balance Strategy

To distribute the data in a flow across the nodes in the cluster, NiFi offers the following load balance strategies:

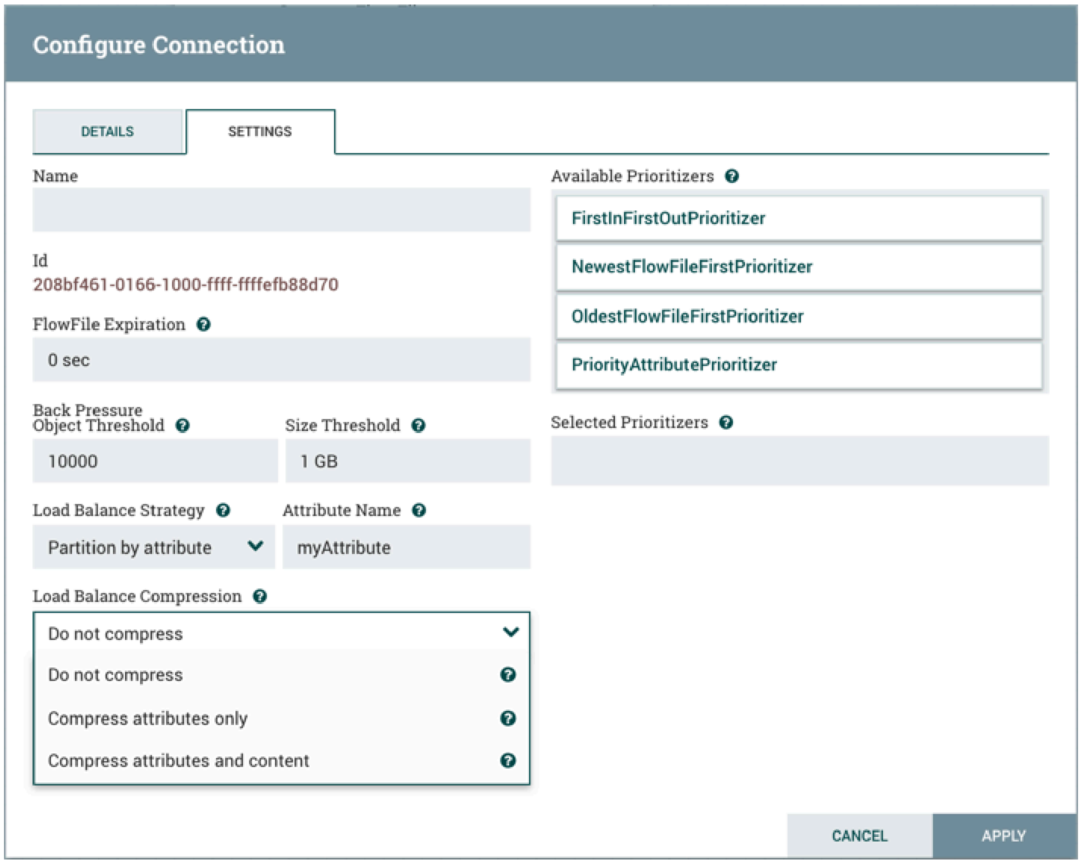
- Do not load balance: Do not load balance FlowFiles between nodes in the cluster. This is the default.
- Partition by attribute: Determines which node to send a given FlowFile to based on the value of a user-specified FlowFile Attribute. All FlowFiles that have the same value for the Attribute will be sent to the same node in the cluster. If the destination node is disconnected from the cluster or if unable to communicate, the data does not fail over to another node. The data will queue, waiting for the node to be available again. Additionally, if a node joins or leaves the cluster necessitating a rebalance of the data, consistent hashing is applied to avoid having to redistribute all of the data.
- Round robin: FlowFiles will be distributed to nodes in the cluster in a round-robin fashion. If a node is disconnected from the cluster or if unable to communicate with a node, the data that is queued for that node will be automatically redistributed to another node(s). If a node is not able to receive the data as fast other nodes in the cluster, the node may also be skipped for one or more iterations in order to maximize throughput of data distribution across the cluster.
- Single node: All FlowFiles will be sent to a single node in the cluster. Which node they are sent to is not configurable. If the node is disconnected from the cluster or if unable to communicate with the node, the data that is queued for that node will remain queued until the node is available again.

Note: In addition to the UI settings, there are Cluster Node Properties related to load balancing that must also be configured in nifi.properties.

Note: NiFi persists the nodes that are in a cluster across restarts. This prevents the redistribution of data until all of the nodes have connected. If the cluster is shutdown and a node is not intended to be brought back up, the user is responsible for removing the node from the cluster via the "Cluster" dialog in the UI (see Managing Nodes for more information).

Load Balance Compression

After selecting the load balance strategy, the user can configure whether or not data should be compressed when being transferred between nodes in the cluster.



Name

Id
208bf461-0166-1000-ffff-ffffefb88d70

FlowFile Expiration
0 sec

Back Pressure Object Threshold
10000

Size Threshold
1 GB

Load Balance Strategy
Partition by attribute

Attribute Name
myAttribute

Load Balance Compression
Do not compress
- Do not compress
- Compress attributes only
- Compress attributes and content

Available Prioritizers
- FirstInFirstOutPrioritizer
- NewestFlowFileFirstPrioritizer
- OldestFlowFileFirstPrioritizer
- PriorityAttributePrioritizer

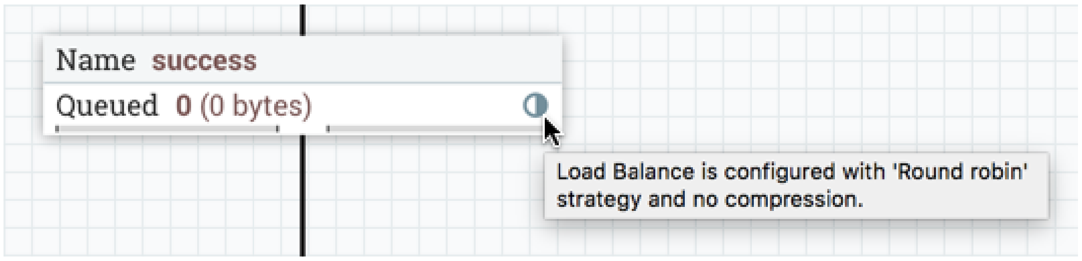
Selected Prioritizers

The following compression options are available:

- Do not compress: FlowFiles will not be compressed. This is the default.
- Compress attributes only: FlowFile attributes will be compressed, but FlowFile contents will not.
- Compress attributes and content: FlowFile attributes and contents will be compressed.

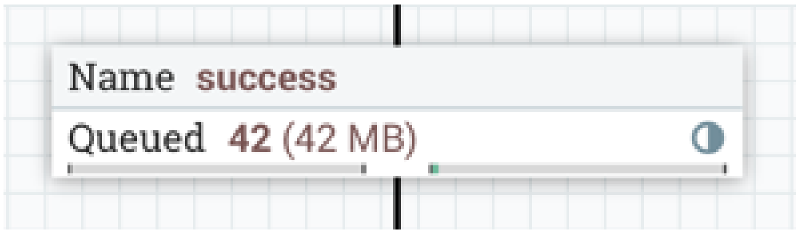
Load Balance Indicator

When a load balance strategy has been implemented for a connection, a load balance indicator (◐) will appear on the connection:

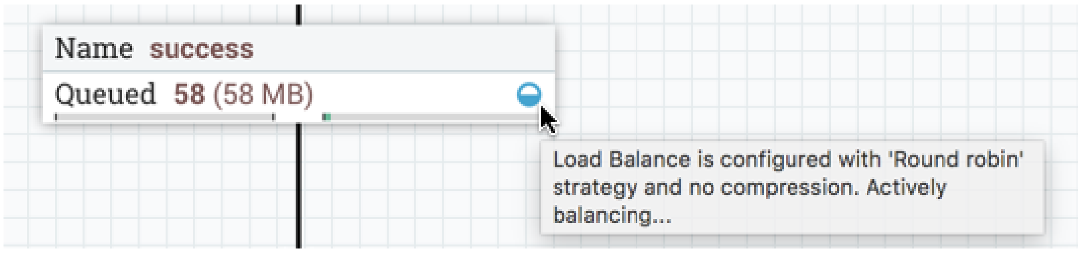

Name success
Queued 0 (0 bytes)

Load Balance is configured with 'Round robin' strategy and no compression.

Hovering over the icon will display the connection's load balance strategy and compression configuration. The icon in this state also indicates that all data in the connection has been distributed across the cluster.



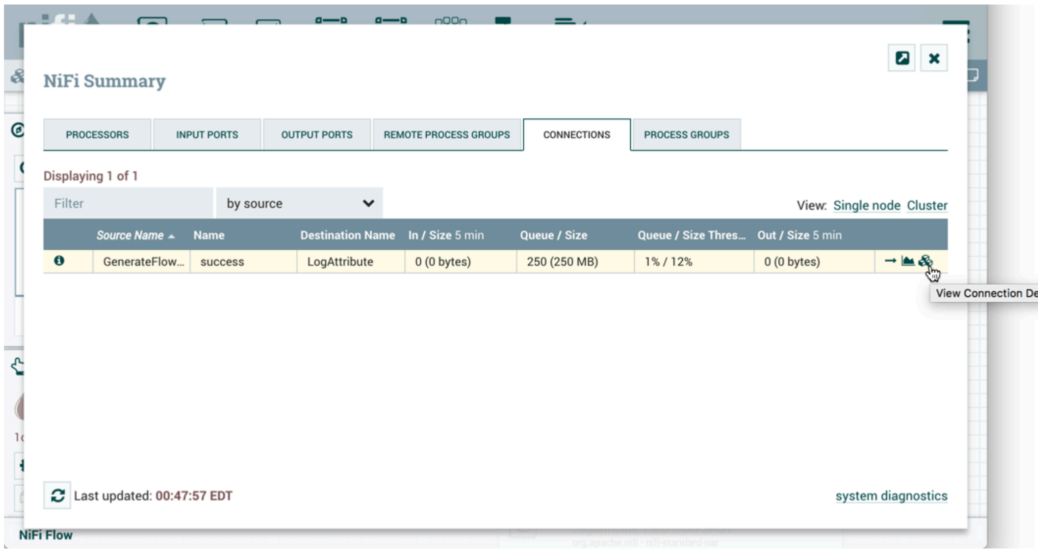
When data is actively being transferred between the nodes in the cluster, the load balance indicator will change orientation and color:



Load Balance is configured with 'Round robin' strategy and no compression. Actively balancing...

Cluster Connection Summary

To see where data has been distributed among the cluster nodes, select Summary from the Global Menu. Then select the "Connections" tab and the "View Connection Details" icon for a source:

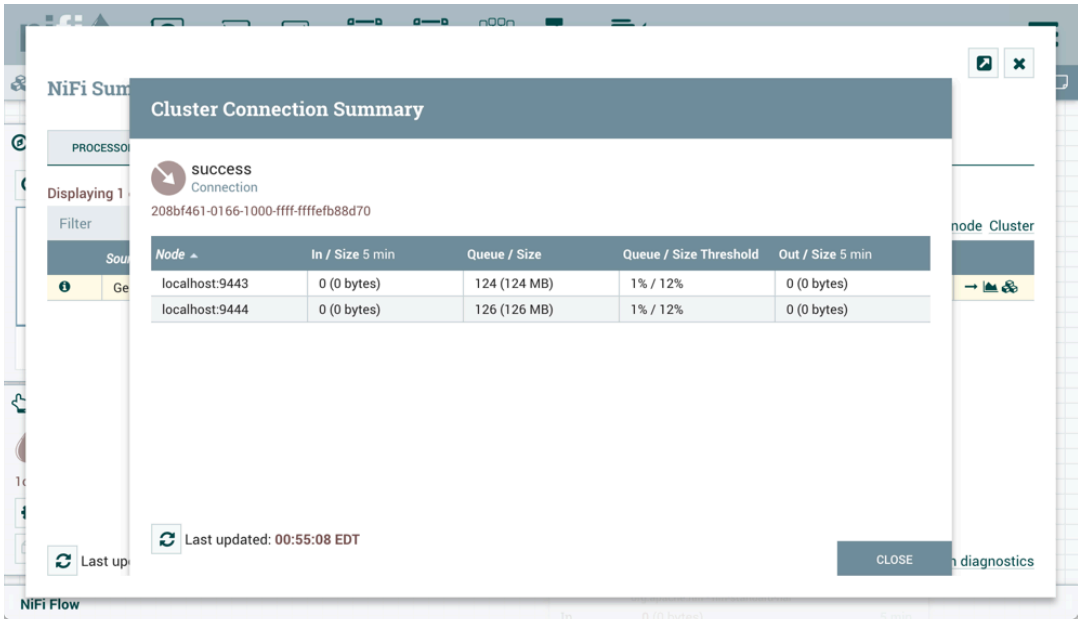


Displaying 1 of 1

	Source Name	Name	Destination Name	In / Size 5 min	Queue / Size	Queue / Size Thres...	Out / Size 5 min
	GenerateFlow...	success	LogAttribute	0 (0 bytes)	250 (250 MB)	1% / 12%	0 (0 bytes)

Last updated: 00:47:57 EDT

This will open the Cluster Connection Summary dialog, which shows the data on each node in the cluster:


Cluster Connection Summary
success
Connection
208bf461-0166-1000-ffff-ffffefb88d70
Last updated: 00:55:08 EDT
CLOSE

Node	In / Size 5 min	Queue / Size	Queue / Size Threshold	Out / Size 5 min
localhost:9443	0 (0 bytes)	124 (124 MB)	1% / 12%	0 (0 bytes)
localhost:9444	0 (0 bytes)	126 (126 MB)	1% / 12%	0 (0 bytes)

Prioritization

The right-hand side of the tab provides the ability to prioritize the data in the queue so that higher priority data is processed first. Prioritizers can be dragged from the top ('Available prioritizers') to the bottom ('Selected prioritizers'). Multiple prioritizers can be selected. The prioritizer that is at the top of the 'Selected prioritizers' list is the highest priority. If two FlowFiles have the same value according to this prioritizer, the second prioritizer will determine which FlowFile to process first, and so on. If a prioritizer is no longer desired, it can then be dragged from the 'Selected prioritizers' list to the 'Available prioritizers' list.

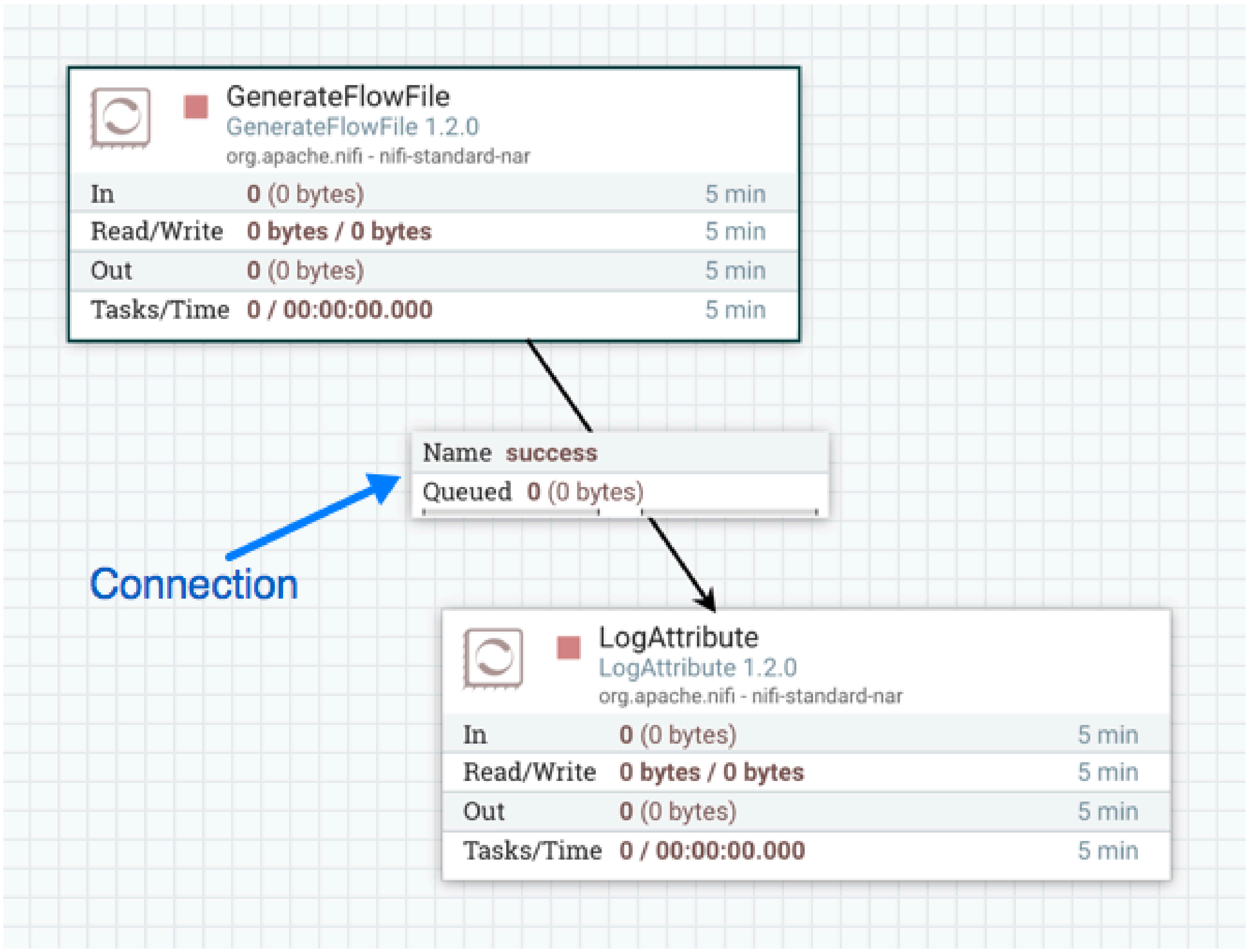
The following prioritizers are available:

- FirstInFirstOutPrioritizer: Given two FlowFiles, the one that reached the connection first will be processed first.
- NewestFlowFileFirstPrioritizer: Given two FlowFiles, the one that is newest in the dataflow will be processed first.
- OldestFlowFileFirstPrioritizer: Given two FlowFiles, the one that is oldest in the dataflow will be processed first. 'This is the default scheme that is used if no prioritizers are selected'.
- PriorityAttributePrioritizer: Given two FlowFiles, an attribute called "priority" will be extracted. The one that has the lowest priority value will be processed first.
  - Note that an UpdateAttribute processor should be used to add the "priority" attribute to the FlowFiles before they reach a connection that has this prioritizer set.
  - If only one has that attribute it will go first.
  - Values for the "priority" attribute can be alphanumeric, where "a" will come before "z" and "1" before "9"
  - If "priority" attribute cannot be parsed as a long, unicode string ordering will be used. For example: "99" and "100" will be ordered so the flowfile with "99" comes first, but "A-99" and "A-100" will sort so the flowfile with "A-100" comes first.

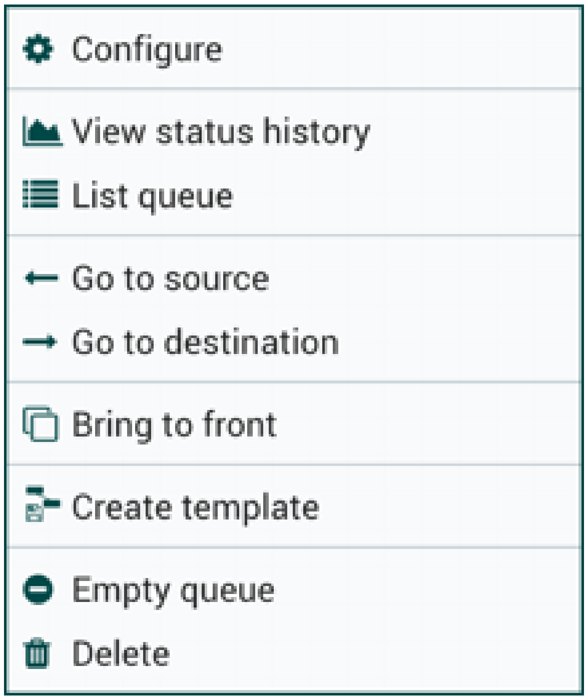
Note: With a Load Balance Strategy configured, the connection has a queue per node in addition to the local queue. The prioritizer will sort the data in each queue independently.

Changing Configuration and Context Menu Options

After a connection has been drawn between two components, the connection's configuration may be changed, and the connection may be moved to a new destination; however, the processors on either side of the connection must be stopped before a configuration or destination change may be made.


GenerateFlowFile
GenerateFlowFile 1.2.0
org.apache.nifi - nifi-standard-nar
In 0 (0 bytes) 5 min
Read/Write 0 bytes / 0 bytes 5 min
Out 0 (0 bytes) 5 min
Tasks/Time 0 / 00:00:00.000 5 min
Name success
Queued 0 (0 bytes)
Connection
LogAttribute
LogAttribute 1.2.0
org.apache.nifi - nifi-standard-nar
In 0 (0 bytes) 5 min
Read/Write 0 bytes / 0 bytes 5 min
Out 0 (0 bytes) 5 min
Tasks/Time 0 / 00:00:00.000 5 min

To change a connection's configuration or interact with the connection in other ways, right-click on the connection to open the connection context menu.

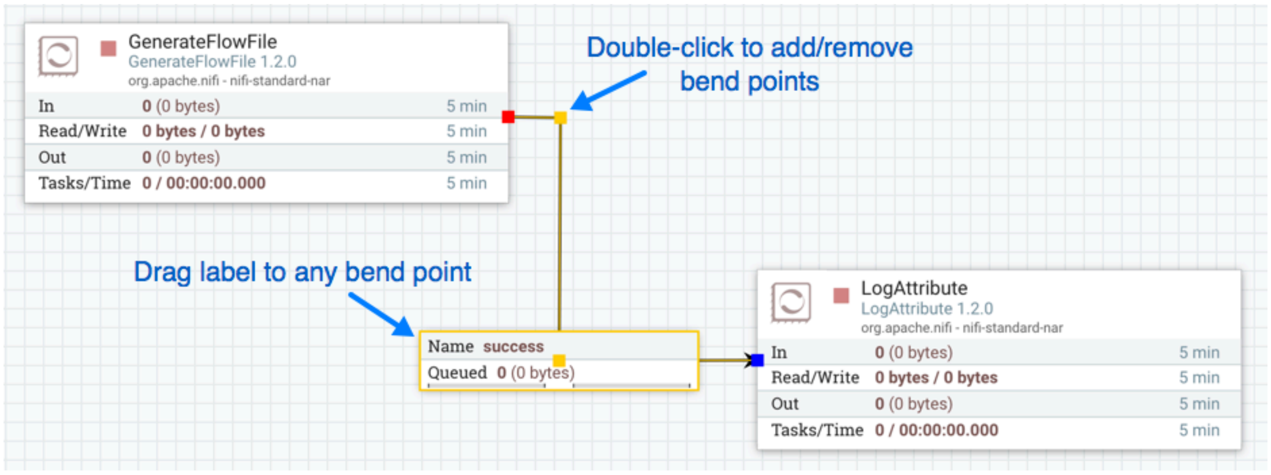


The following options are available:

- Configure: This option allows the user to change the configuration of the connection.
- View status history: This option opens a graphical representation of the connection's statistical information over time.
- List queue: This option lists the queue of FlowFiles that may be waiting to be processed.
- Go to source: This option can be useful if there is a long distance between the connection's source and destination components on the canvas. By clicking this option, the view of the canvas will jump to the source of the connection.
- Go to destination: Similar to the "Go to source" option, this option changes the view to the destination component on the canvas and can be useful if there is a long distance between two connected components.
- Bring to front: This option brings the connection to the front of the canvas if something else (such as another connection) is overlapping it.
- Empty queue: This option allows the DFM to clear the queue of FlowFiles that may be waiting to be processed. This option can be especially useful during testing, when the DFM is not concerned about deleting data from the queue. When this option is selected, users must confirm that they want to delete the data in the queue.
- Delete: This option allows the DFM to delete a connection between two components. Note that the components on both sides of the connection must be stopped and the connection must be empty before it can be deleted.

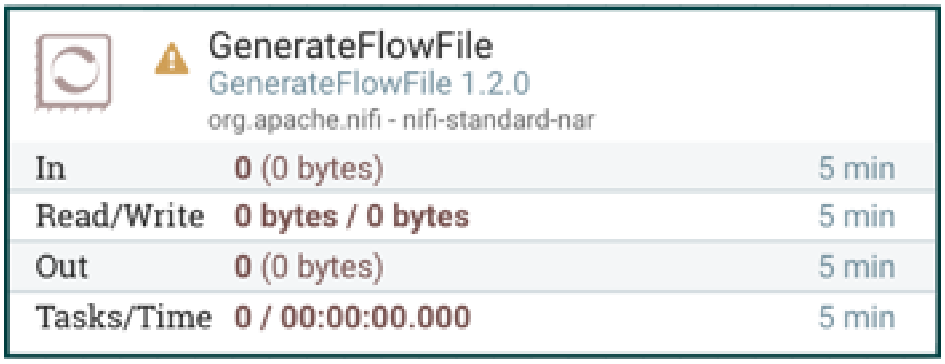
Bending Connections

To add a bend point (or elbow) to an existing connection, simply double-click on the connection in the spot where you want the bend point to be. Then, you can use the mouse to grab the bend point and drag it so that the connection is bent in the desired way. You can add as many bend points as you want. You can also use the mouse to drag and move the label on the connection to any existing bend point. To remove a bend point, simply double-click it again.


GenerateFlowFile
GenerateFlowFile 1.2.0
org.apache.nifi - nifi-standard-nar
In 0 (0 bytes) 5 min
Read/Write 0 bytes / 0 bytes 5 min
Out 0 (0 bytes) 5 min
Tasks/Time 0 / 00:00:00.000 5 min
Double-click to add/remove bend points
Drag label to any bend point
Name success
Queued 0 (0 bytes)
LogAttribute
LogAttribute 1.2.0
org.apache.nifi - nifi-standard-nar
In 0 (0 bytes) 5 min
Read/Write 0 bytes / 0 bytes 5 min
Out 0 (0 bytes) 5 min
Tasks/Time 0 / 00:00:00.000 5 min

Processor Validation

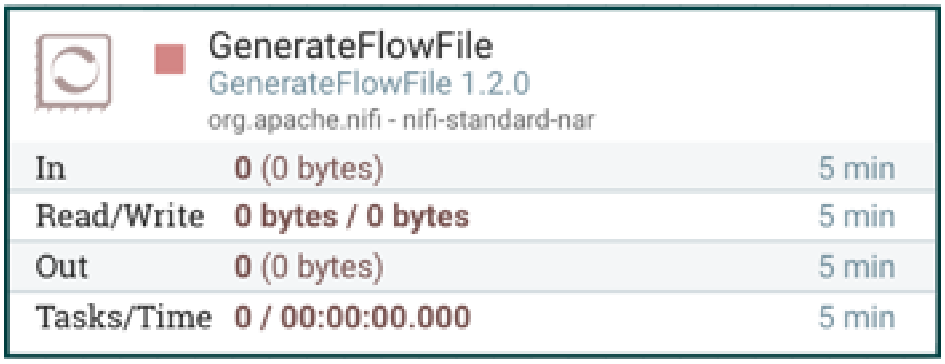
Before trying to start a Processor, it's important to make sure that the Processor's configuration is valid. A status indicator is shown in the top-left of the Processor. If the Processor is invalid, the indicator will show a yellow Warning indicator with an exclamation mark indicating that there is a problem:



GenerateFlowFile
GenerateFlowFile 1.2.0
org.apache.nifi - nifi-standard-nar

In	0 (0 bytes)	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 (0 bytes)	5 min
Tasks/Time	0 / 00:00:00.000	5 min

In this case, hovering over the indicator icon with the mouse will provide a tooltip showing all of the validation errors for the Processor. Once all of the validation errors have been addressed, the status indicator will change to a Stop icon, indicating that the Processor is valid and ready to be started but currently is not running:



GenerateFlowFile
GenerateFlowFile 1.2.0
org.apache.nifi - nifi-standard-nar

In	0 (0 bytes)	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 (0 bytes)	5 min
Tasks/Time	0 / 00:00:00.000	5 min

Site-to-Site

When sending data from one instance of NiFi to another, there are many different protocols that can be used. The preferred protocol, though, is the NiFi Site-to-Site Protocol. Site-to-Site makes it easy to securely and efficiently transfer data to/from nodes in one NiFi instance or data producing application to nodes in another NiFi instance or other consuming application.

Using Site-to-Site provides the following benefits:

- Easy to configure
  - After entering the URL(s) of the remote NiFi instance/cluster, the available ports (endpoints) are automatically discovered and provided in a drop-down list.
- Secure
  - Site-to-Site optionally makes use of Certificates in order to encrypt data and provide authentication and authorization. Each port can be configured to allow only specific users, and only those users will be able to see that the port even exists. For information on configuring the Certificates, see the Security Configuration section of the System Administrator’s Guide.
- Scalable
  - As nodes in the remote cluster change, those changes are automatically detected and data is scaled out across all nodes in the cluster.
- Efficient
  - Site-to-Site allows batches of FlowFiles to be sent at once in order to avoid the overhead of establishing connections and making multiple round-trip requests between peers.

- Reliable
    - Checksums are automatically produced by both the sender and receiver and compared after the data has been transmitted, in order to ensure that no corruption has occurred. If the checksums don't match, the transaction will simply be canceled and tried again.
- Automatically load balanced
    - As nodes come online or drop out of the remote cluster, or a node's load becomes heavier or lighter, the amount of data that is directed to that node will automatically be adjusted.
- FlowFiles maintain attributes
    - When a FlowFile is transferred over this protocol, all of the FlowFile's attributes are automatically transferred with it. This can be very advantageous in many situations, as all of the context and enrichment that has been determined by one instance of NiFi travels with the data, making for easy routing of the data and allowing users to easily inspect the data.
- Adaptable
    - As new technologies and ideas emerge, the protocol for handling Site-to-Site communications are able to change with them. When a connection is made to a remote NiFi instance, a handshake is performed in order to negotiate which protocol and which version of the protocol will be used. This allows new capabilities to be added while still maintaining backward compatibility with all older instances. Additionally, if a vulnerability or deficiency is ever discovered in a protocol, it allows a newer version of NiFi to forbid communication over the compromised versions of the protocol.

Site-to-Site is a protocol transferring data between two NiFi instances. Both end can be a standalone NiFi or a NiFi cluster. In this section, the NiFi instance initiates the communications is called Site-to-Site client NiFi instance and the other end as Site-to-Site server NiFi instance to clarify what configuration needed on each NiFi instances.

A NiFi instance can be both client and server for Site-to-Site protocol, however, it can only be a client or server within a specific Site-to-Site communication. For example, if there are three NiFi instances A, B and C. A pushes data to B, and B pulls data from C. A - push # B # pull - C. Then B is not only a server in the communication between A and B, but also a client in B and C.

It is important to understand which NiFi instance will be the client or server in order to design your data flow, and configure each instance accordingly. Here is a summary of what components run on which side based on data flow direction:

- Push: a client sends data to a Remote Process Group, the server receives it with an Input Port
- Pull: a client receives data from a Remote Process Group, the server sends data through an Output Port

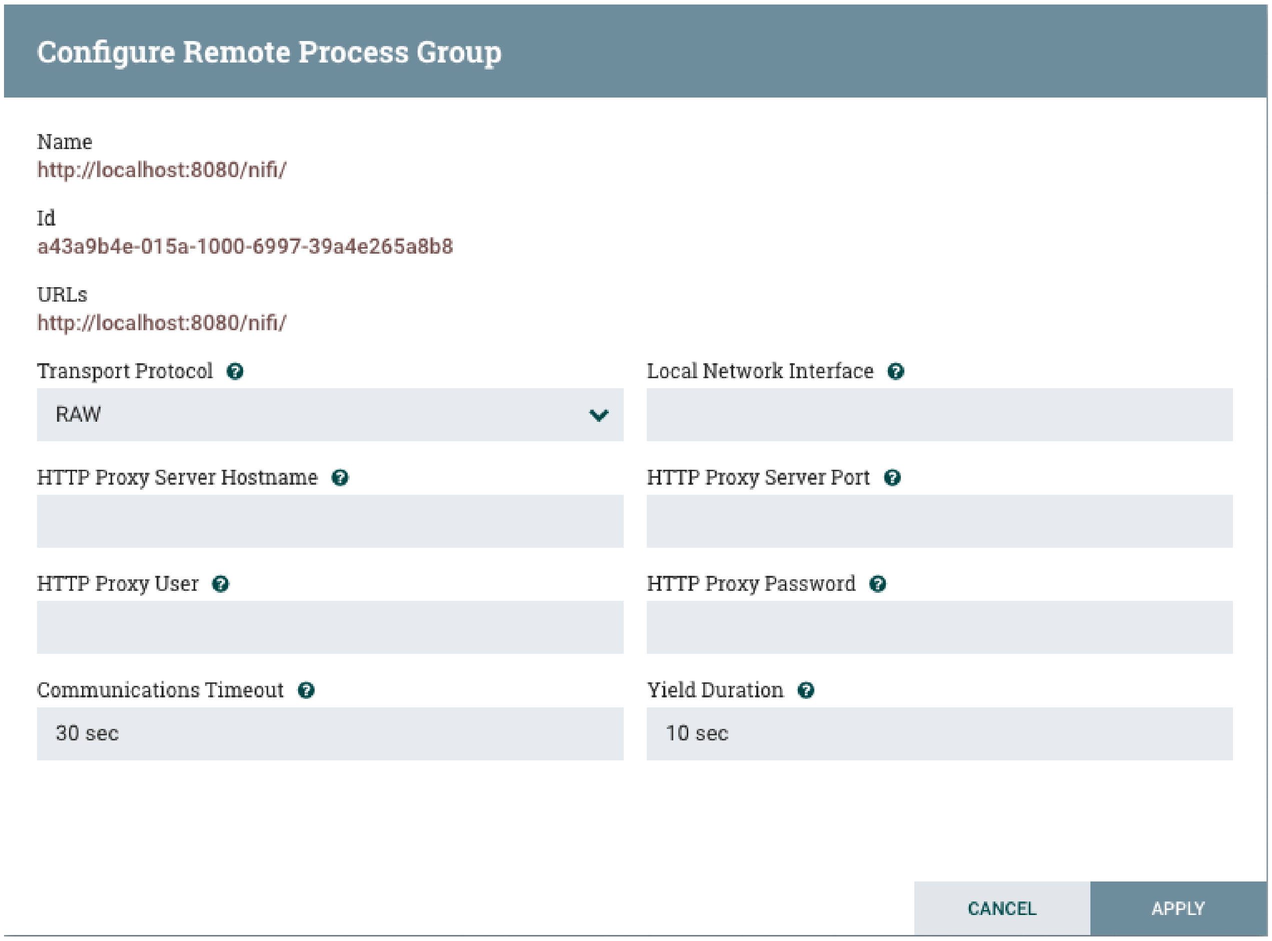
Configure Site-to-Site client NiFi instance

Remote Process Group: In order to communicate with a remote NiFi instance via Site-to-Site, simply drag a Remote Process Group onto the canvas and enter the URL(s) of the remote NiFi instance (for more information on the components of a Remote Process Group, see the Remote Process Group Transmission section of this guide.) The URL is the same URL you would use to go to that instance's User Interface or in the case of a cluster, the URLs of the cluster nodes. At this point, you can drag a connection to or from the Remote Process Group in the same way you would drag a connection to or from a Processor or a local Process Group. When you drag the connection, you will have a chance to choose which Port to connect to. Note that it may take up to one minute for the Remote Process Group to determine which ports are available.

If the connection is dragged starting from the Remote Process Group, the ports shown will be the Output Ports of the remote group, as this indicates that you will be pulling data from the remote instance. If the connection instead ends on the Remote Process Group, the ports shown will be the Input Ports of the remote group, as this implies that you will be pushing data to the remote instance.

Note: If the remote instance is configured to use secure data transmission, you will see only ports that you are authorized to communicate with. For information on configuring NiFi to run securely, see the System Administrator’s Guide.

Transport Protocol: On a Remote Process Group creation or configuration dialog, you can choose Transport Protocol to use for Site-to-Site communication as shown in the following image:



Configure Remote Process Group

Name
http://localhost:8080/nifi/

Id
a43a9b4e-015a-1000-6997-39a4e265a8b8

URLs
http://localhost:8080/nifi/

Transport Protocol: RAW

Local Network Interface:

HTTP Proxy Server Hostname:

HTTP Proxy Server Port:

HTTP Proxy User:

HTTP Proxy Password:

Communications Timeout: 30 sec

Yield Duration: 10 sec

By default, it is set to RAW which uses raw socket communication using a dedicated port. HTTP transport protocol is especially useful if the remote NiFi instance is in a restricted network that only allow access through HTTP(S) protocol or only accessible from a specific HTTP Proxy server. For accessing through a HTTP Proxy Server, BASIC and DIGEST authentication are supported.

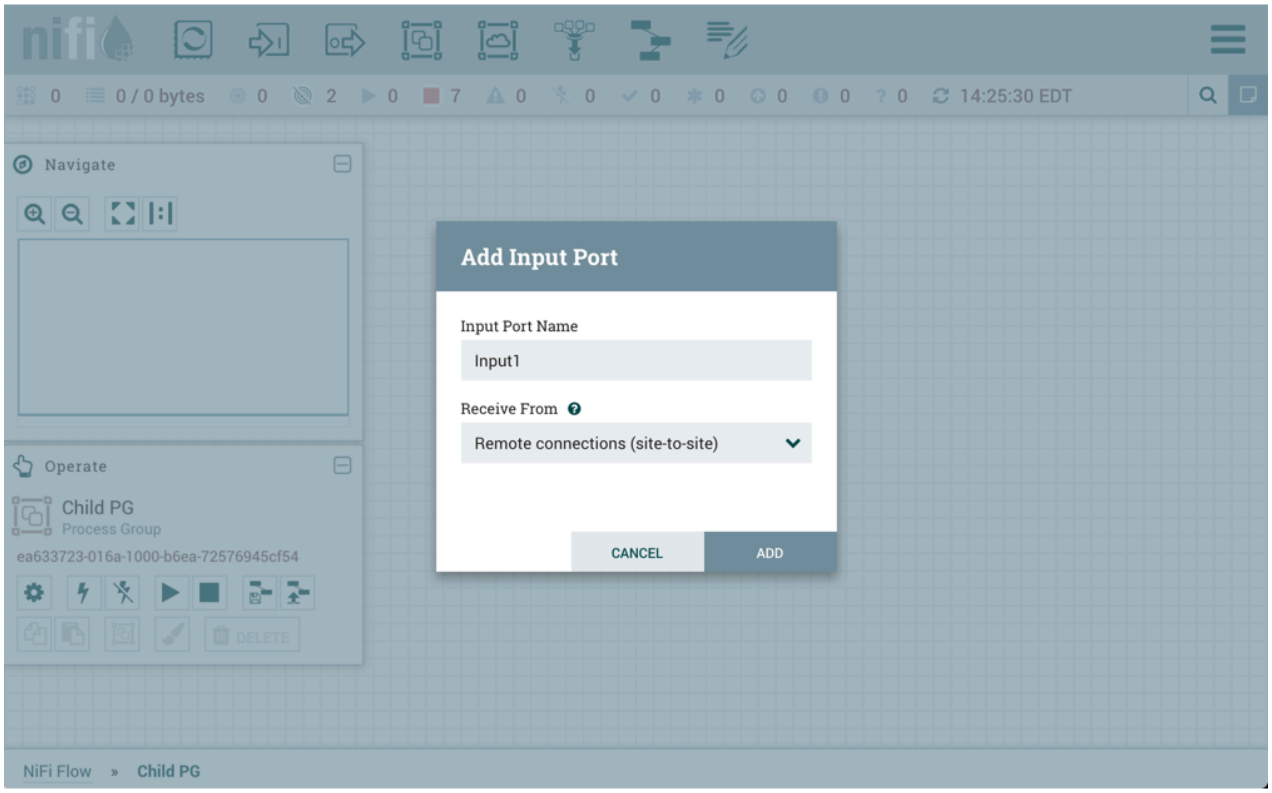
Local Network Interface: In some cases, it may be desirable to prefer one network interface over another. For example, if a wired interface and a wireless interface both exist, the wired interface may be preferred. This can be configured by specifying the name of the network interface to use in this box. If the value entered is not valid, the Remote Process Group will not be valid and will not communicate with other NiFi instances until this is resolved.

Configure Site-to-Site Server NiFi Instance

Retrieve Site-to-Site Details: If your NiFi is running securely, in order for another NiFi instance to retrieve information from your instance, it needs to be added to the Global Access "retrieve site-to-site details" policy. This will allow the other instance to query your instance for details such as name, description, available peers (nodes when clustered), statistics, OS port information and available Input and Output ports. Utilizing Input and Output ports in a secured instance requires additional policy configuration as described below.

Input Port: In order to allow another NiFi instance to push data to your local instance, you can simply drag an Input Port onto the Root Process Group of your canvas. After entering a name for the port, it will be added to your flow. You can now right-click on the Input Port and choose Configure in order to adjust the name and the number of concurrent tasks that are used for the port.

To create an Input Port for Site-to-Site in a child Process Group, enter the name for the port and select "Remote connections (site-to-site)" from the Receive From drop-down menu.



Add Input Port

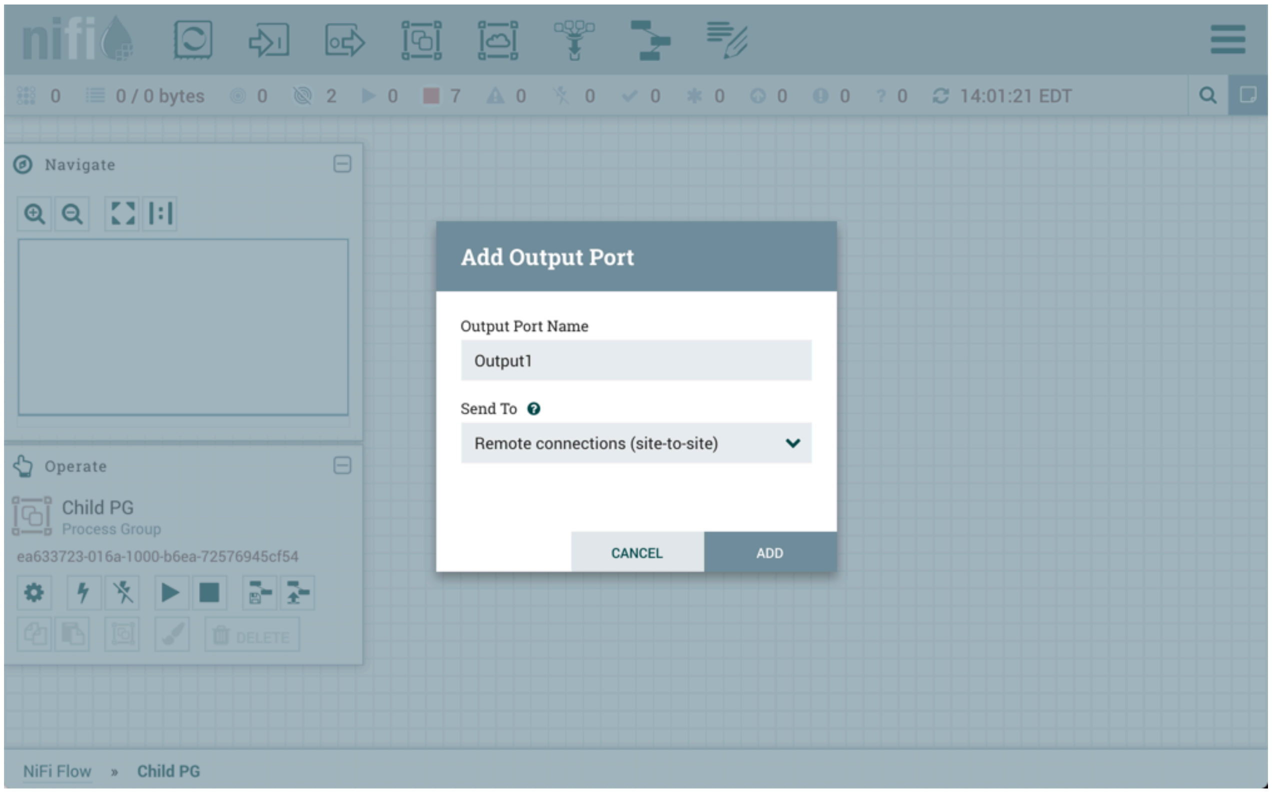
Input Port Name: Input1

Receive From: Remote connections (site-to-site)

If Site-to-Site is configured to run securely, you will need to manage the input port's "receive data via site-to-site" component access policy. Only those users who have been added to the policy will be able to communicate with the port.

Output Port: Similar to an Input Port, a DataFlow Manager may choose to add an Output Port to the Root Process Group. The Output Port allows an authorized NiFi instance to remotely connect to your instance and pull data from the Output Port. After dragging an Output Port onto the canvas, right-click and choose Configure to adjust the name and how many concurrent tasks are allowed. Manage the output port's "receive data via site-to-site" component access policy to control which users are authorized to pull data from the instance being configured.

To create an Output Port for Site-to-Site in a child Process Group, enter the name for the port and select "Remote connections (site-to-site)" from the Send To drop-down menu.



Add Output Port

Output Port Name: Output1

Send To: Remote connections (site-to-site)

CANCEL ADD

In addition to other instances of NiFi, some other applications may use a Site-to-Site client in order to push data to or receive data from a NiFi instance. For example, NiFi provides an Apache Storm spout and an Apache Spark Receiver that are able to pull data from NiFi's Output Ports for Site-to-Site connections.

Note: For information on how to enable and configure Site-to-Site on a NiFi instance, see the Site-to-Site Properties section of the System Administrator’s Guide.

Note: For information on how to configure access policies, see the Access Policies section of the System Administrator’s Guide.

Example Dataflow

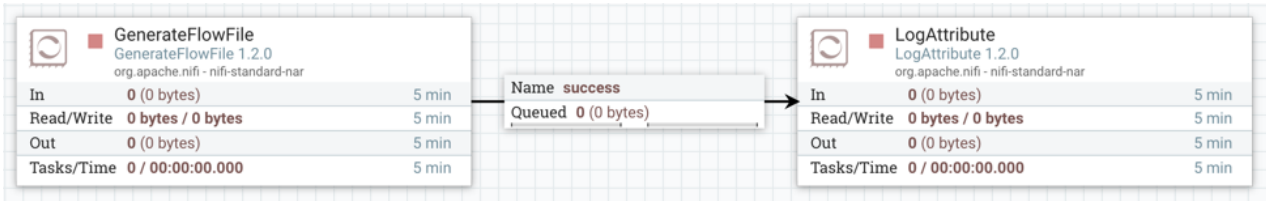
This section has described the steps required to build a dataflow. Now, to put it all together. The following example dataflow consists of just two processors: GenerateFlowFile and LogAttribute. These processors are normally used for testing, but they can also be used to build a quick flow for demonstration purposes and see NiFi in action.

After you drag the GenerateFlowFile and LogAttribute processors to the canvas and connect them (using the guidelines provided above), configure them as follows:

- Generate FlowFile
  - On the Scheduling tab, set Run schedule to: 5 sec. Note that the GenerateFlowFile processor can create many FlowFiles very quickly; that's why setting the Run schedule is important so that this flow does not overwhelm the system NiFi is running on.
  - On the Properties tab, set File Size to: 10 KB

- Log Attribute
  - On the Settings tab, under Auto-terminate relationships, select the checkbox next to Success. This will terminate FlowFiles after this processor has successfully processed them.
  - Also on the Settings tab, set the Bulletin level to Info. This way, when the dataflow is running, this processor will display the bulletin icon (see Anatomy of a Processor), and the user may hover over it with the mouse to see the attributes that the processor is logging.

The dataflow should look like the following:



GenerateFlowFile
GenerateFlowFile 1.2.0
org.apache.nifi - nifi-standard-nar

In	0 (0 bytes)	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 (0 bytes)	5 min
Tasks/Time	0 / 00:00:00.000	5 min

Name success
Queued 0 (0 bytes)

LogAttribute
LogAttribute 1.2.0
org.apache.nifi - nifi-standard-nar

In	0 (0 bytes)	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 (0 bytes)	5 min
Tasks/Time	0 / 00:00:00.000	5 min

Now see the following section on how to start and stop the dataflow. When the dataflow is running, be sure to note the statistical information that is displayed on the face of each processor (see Anatomy of a Processor).

Command and Control of the DataFlow

When a component is added to the NiFi canvas, it is in the Stopped state. In order to cause the component to be triggered, the component must be started. Once started, the component can be stopped at any time. From a Stopped state, the component can be configured, started, or disabled.

Starting a Component

In order to start a component, the following conditions must be met:

- The component's configuration must be valid.
- All defined Relationships for the component must be connected to another component or auto-terminated.
- The component must be stopped.
- The component must be enabled.
- The component must have no active tasks. For more information about active tasks, see the "Anatomy of …" sections under Monitoring of DataFlow (Anatomy of a Processor, Anatomy of a Process Group, Anatomy of a Remote Process Group).

Components can be started by selecting all of the components to start and then clicking the "Start" button (▶) in the Operate Palette or by right-clicking a single component and choosing Start from the context menu.

If starting a Process Group, all components within that Process Group (including child Process Groups) will be started, with the exception of those components that are invalid or disabled.

Once started, the status indicator of a Processor will change to a Play symbol (▶).

Stopping a Component

A component can be stopped any time that it is running. A component is stopped by right-clicking on the component and clicking Stop from the context menu, or by selecting the component and clicking the "Stop" button ( ) in the Operate Palette.

If a Process Group is stopped, all of the components within the Process Group (including child Process Groups) will be stopped.

Once stopped, the status indicator of a component will change to the Stop symbol ( ).

Stopping a component does not interrupt its currently running tasks. Rather, it stops scheduling new tasks to be performed. The number of active tasks is shown in the top-right corner of the Processor (See Anatomy of a Processor for more information). See Terminating a Component’s tasks for how to terminate the running tasks.

Terminating a Component's tasks

When a component is stopped, it does not interrupt the currently running tasks. This allows for the current execution to complete while no new tasks are scheduled, which is the desired behaviour in many cases. In some cases, it is desirable to terminate the running tasks, particularly in cases where a task has hung and is no longer responsive, or while developing new flows.

To be able to terminate the running task(s), the component must first be stopped (see Stopping a Component). Once the component is in the Stopped state, the Terminate option will become available only if there are tasks still running (See Anatomy of a Processor). The Terminate option ( ) can be accessed either via the context menu or the Operations Palette while the component is selected.

The number of tasks that are actively being terminated will be displayed in parentheses next to the number of active tasks e.g. 0 (1). For example, if there is one active task at the time that Terminate is selected, this will display "0 (1)" - meaning 0 active tasks and 1 task being terminated.

A task may not terminate immediately, as different components may respond to the Terminate command differently. However, the components can be reconfigured and started/stopped regardless of whether there are tasks still in the terminating state.

Enabling/Disabling a Component

When a component is enabled, it is able to be started. Users may choose to disable components when they are part of a dataflow that is still being assembled, for example. Typically, if a component is not intended to be run, the component is disabled, rather than being left in the Stopped state. This helps to distinguish between components that are intentionally not running and those that may have been stopped temporarily (for instance, to change the component's configuration) and inadvertently were never restarted.

When it is desirable to re-enable a component, it can be enabled by selecting the component and clicking the "Enable" button ( ) in the Operate Palette. This is available only when the selected component or components are disabled. Alternatively, a component can be enabled by checking the checkbox next to the "Enabled" option in the Settings tab of the Processor configuration dialog or the configuration dialog for a Port.

Once enabled, the component's status indicator will change to either Invalid ( ) or Stopped ( ), depending on whether or not the component is valid.

A component is then disabled by selecting the component and clicking the "Disable" button ( ) in the Operate Palette, or by clearing the checkbox next to the "Enabled" option in the Settings tab of the Processor configuration dialog or the configuration dialog for a Port.

Only Ports and Processors can be enabled and disabled.

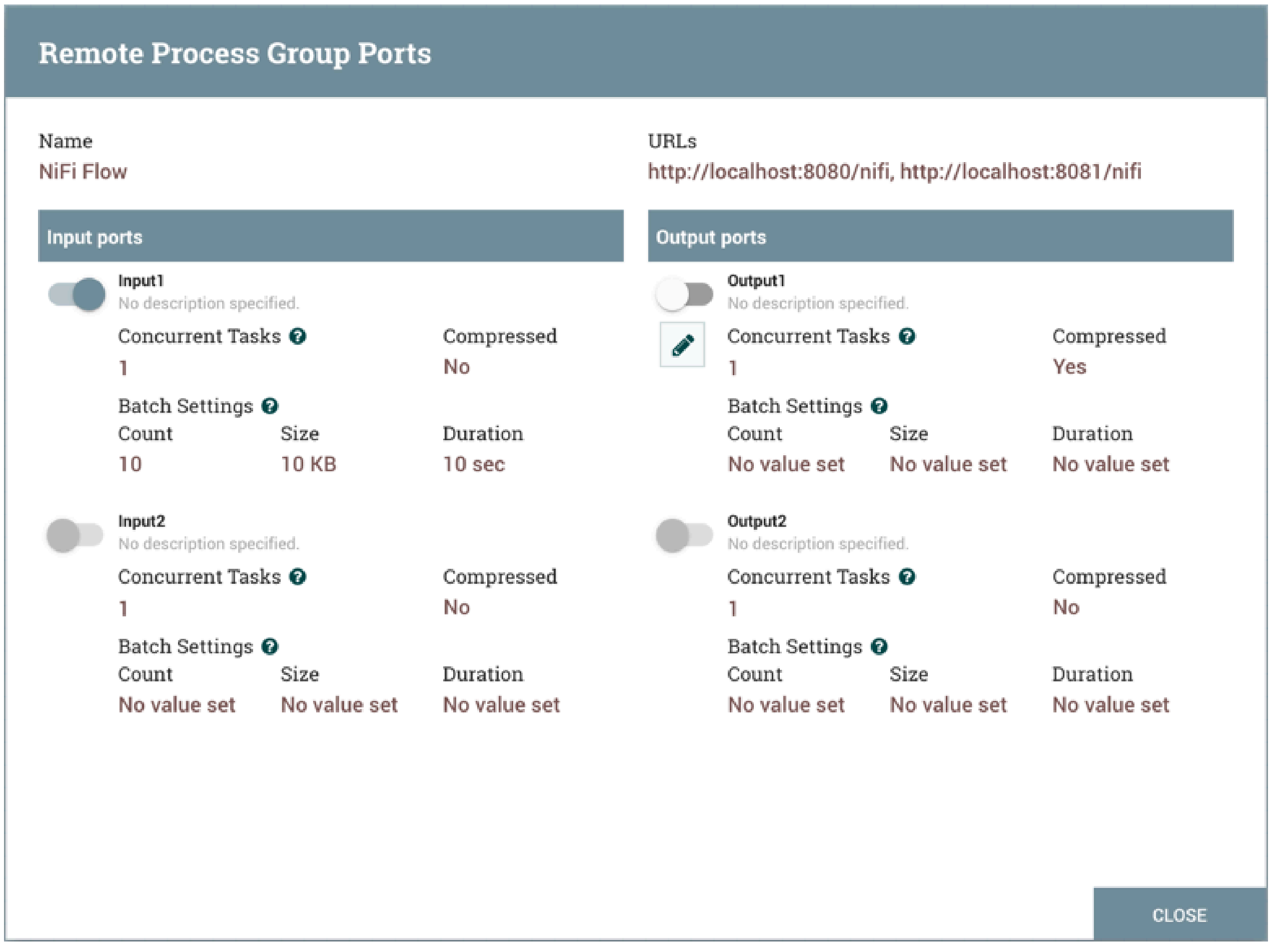
Remote Process Group Transmission

Remote Process Groups provide a mechanism for sending data to or retrieving data from a remote instance of NiFi. When a Remote Process Group (RPG) is added to the canvas, it is added with the Transmission Disabled, as indicated by the icon ( ) in the top-left corner. When Transmission is Disabled, it can be enabled by right-clicking on the RPG and clicking the "Enable transmission" menu item. This will cause all ports for which there is a Connection to begin transmitting data. This will cause the status indicator to then change to the Transmission Enabled icon ( ).

If there are problems communicating with the Remote Process Group, a Warning indicator ( ) may instead be present in the top-left corner. Hovering over this Warning indicator with the mouse will provide more information about the problem.

Individual Port Transmission

There are times when the DFM may want to either enable or disable transmission for only a specific port within the Remote Process Group. This can be accomplished by right-clicking on the Remote Process Group and choosing the "Manage remote ports" menu item. This provides a configuration dialog from which ports can be configured:



Remote Process Group Ports

Name
NiFi Flow

URLs
http://localhost:8080/nifi, http://localhost:8081/nifi

Input ports

Input1
No description specified.

Concurrent Tasks		Compressed
1		No
Batch Settings		
Count	Size	Duration
10	10 KB	10 sec

Input2
No description specified.

Concurrent Tasks		Compressed
1		No
Batch Settings		
Count	Size	Duration
No value set	No value set	No value set

Output ports

Output1
No description specified.

Concurrent Tasks		Compressed
1		Yes
Batch Settings		
Count	Size	Duration
No value set	No value set	No value set

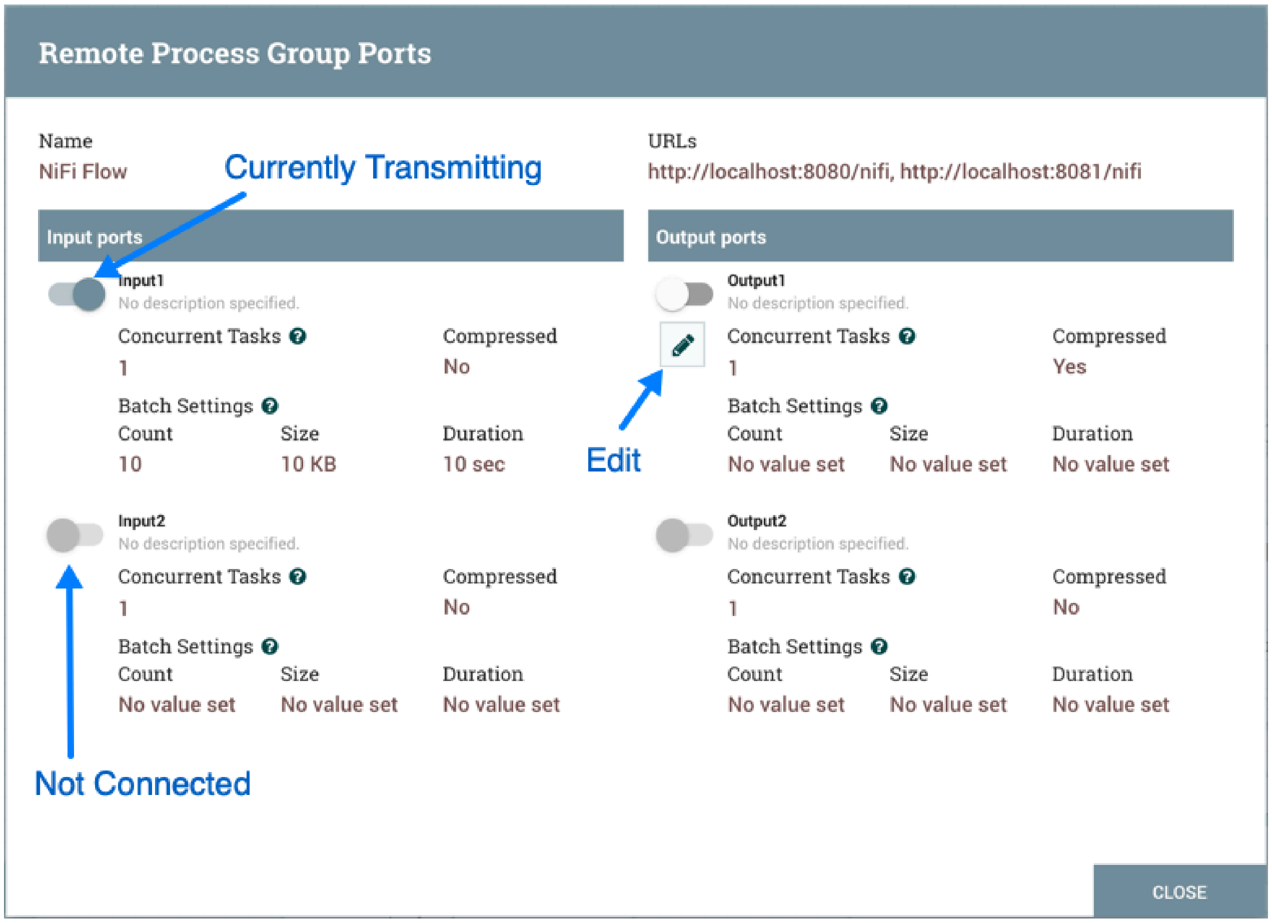
Output2
No description specified.

Concurrent Tasks		Compressed
1		No
Batch Settings		
Count	Size	Duration
No value set	No value set	No value set

The left-hand side lists all of the Input Ports that the remote instance of NiFi allows data to be sent to. The right-hand side lists all of the Output Ports from which this instance is able to pull data. If the remote instance is using secure communications (the URL of the NiFi instance begins with https://, rather than http://), any ports that the remote instance has not made available to this instance will not be shown.

Note: If a port that is expected to be shown is not shown in this dialog, ensure that the instance has proper permissions and that the Remote Process Group's flow is current. This can be checked by closing the Remote Process Group Ports dialog and looking at the bottom-left corner of the Remote Process Group. The date and time when the flow was last refreshed is displayed. If the flow appears to be outdated, it can be updated by right-clicking on the Remote Process Group and selecting "Refresh remote". (See Anatomy of a Remote Process Group for more information).

Each port is shown with its Name, its Description, configured number of Concurrent Tasks, and whether or not data sent to this port will be Compressed. Additionally, the port's configured Batch Settings (Count, Size and Duration) are displayed. To the left of this information is a toggle switch to turn the port on or off. Ports that have no connections attached to them are grayed out:



Name
NiFi Flow

URLs
http://localhost:8080/nifi, http://localhost:8081/nifi

Input ports

Input1
No description specified.

Concurrent Tasks		Compressed
1		No

Batch Settings

Count	Size	Duration
10	10 KB	10 sec

Input2
No description specified.

Concurrent Tasks		Compressed
1		No

Batch Settings

Count	Size	Duration
No value set	No value set	No value set

Output ports

Output1
No description specified.

Concurrent Tasks		Compressed
1		Yes

Batch Settings

Count	Size	Duration
No value set	No value set	No value set

Output2
No description specified.

Concurrent Tasks		Compressed
1		No

Batch Settings

Count	Size	Duration
No value set	No value set	No value set

The on/off toggle switch provides a mechanism to enable and disable transmission for each port in the Remote Process Group independently. Those ports that are connected but are not currently transmitting can be configured by clicking the pencil icon ( ) below the on/off toggle switch. Clicking this icon will allow the DFM to change the number of Concurrent Tasks, whether or not compression should be used when transmitting data to or from this port, and Batch Settings.

For an Input Port, the batch settings control how NiFi sends data to the remote input port in a transaction. NiFi will transfer flow files, as they are queued in incoming relationships, until any of the limits (Count, Size, Duration) is met. If none of the settings are configured, a 500 milliseconds batch duration is used by default.

For an Output Port, the batch settings tells the remote NiFi how NiFi prefers to receive data from the remote output port in a transaction. The remote NiFi will use the specified settings (Count, Size, Duration) to control the transfer of flow files. If none of the settings are configured, a 5 seconds batch duration is used by default.

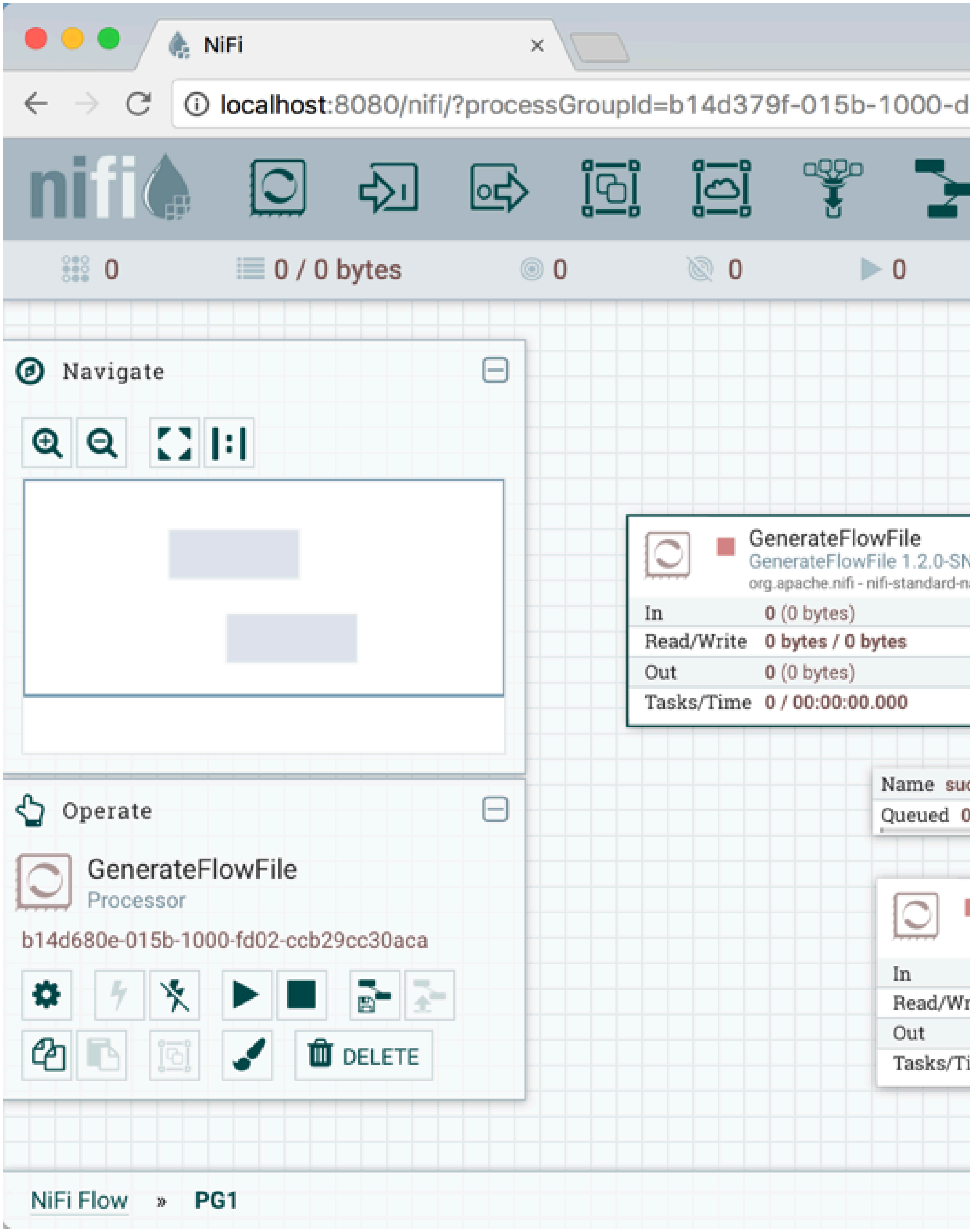
Navigating within a DataFlow

NiFi provides various mechanisms for getting around a dataflow. The NiFi User Interface section describes various ways to navigate around the NiFi canvas; however, once a flow exists on the canvas, there are additional ways to get from one component to another. When multiple Process Groups exist in a flow, breadcrumbs appear at the bottom of the screen, providing a way to navigate between them. In addition, to enter a Process Group that is currently visible on the canvas, simply double-click it, thereby "drilling down" into it. Connections also provide a way to jump from one location to another within the flow. Right-click on a connection and select "Go to source" or "Go to destination" in order to jump to one end of the connection or another. This can be very useful in large, complex dataflows, where the connection lines may be long and span large areas of the canvas. Finally, all components provide the ability to jump forward or backward within the flow. Right-click any component (e.g., a processor, process group, port, etc.) and select either "Upstream connections" or "Downstream connections". A dialog window will open, showing the available upstream or downstream connections that the user may jump to. This can be especially useful when trying to follow a dataflow in a backward direction. It is typically easy to follow the path of a dataflow from start to finish, drilling down into nested process groups; however, it can be more difficult to follow the dataflow in the other direction.

Component Linking

A hyperlink can be used to navigate directly to a component on the NiFi canvas. This is especially useful when Multi-Tenant Authorization is configured. For example, a URL can be given to a user to direct them to the specific process group to which they have privileges.

The default URL for a NiFI instance is http://<hostname>:8080/nifi, which points to the root process group. When a component is selected on the canvas, the URL is updated with the component's process group id and component id in the form http://<hostname>:8080/nifi/?processGroupId=<UUID>&componentIds=<UUIDs>;. In the following screenshot, the GenerateFlowFile processor in the process group PG1 is the selected component:


NiFi
localhost:8080/nifi/?processGroupId=b14d379f-015b-1000-d
nifi
0
0 / 0 bytes
0
0
0
Navigate
Operate
GenerateFlowFile
Processor
b14d680e-015b-1000-fd02-ccb29cc30aca
DELETE
NiFi Flow » PG1

GenerateFlowFile
GenerateFlowFile 1.2.0-SN
org.apache.nifi - nifi-standard-n

In	0 (0 bytes)
Read/Write	0 bytes / 0 bytes
Out	0 (0 bytes)
Tasks/Time	0 / 00:00:00.000

Name	su
Queued	0

In
Read/Wr
Out
Tasks/Ti

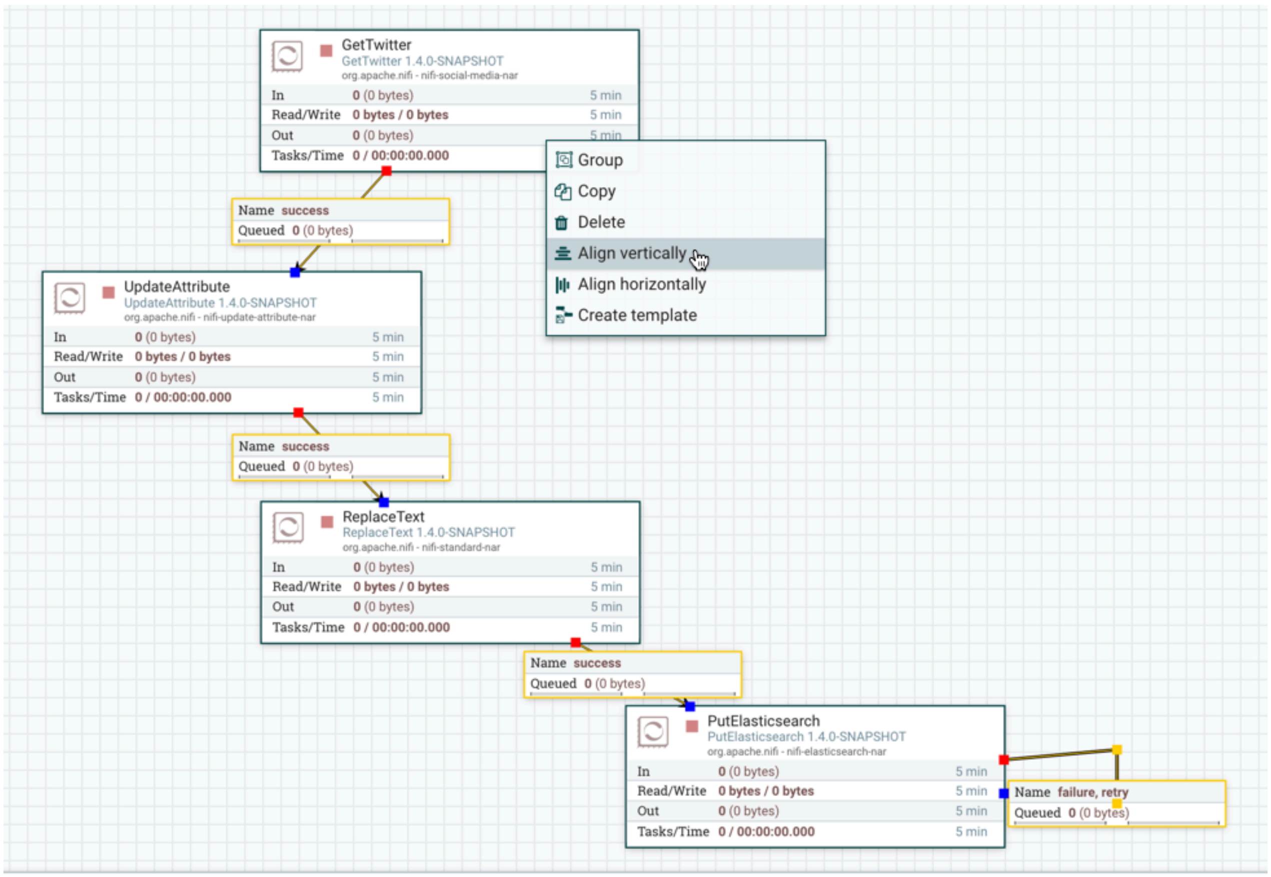
Note: Linking to multiple components on the canvas is supported, with the restriction that the length of the URL cannot exceed a 2000 character limit.

Component Alignment

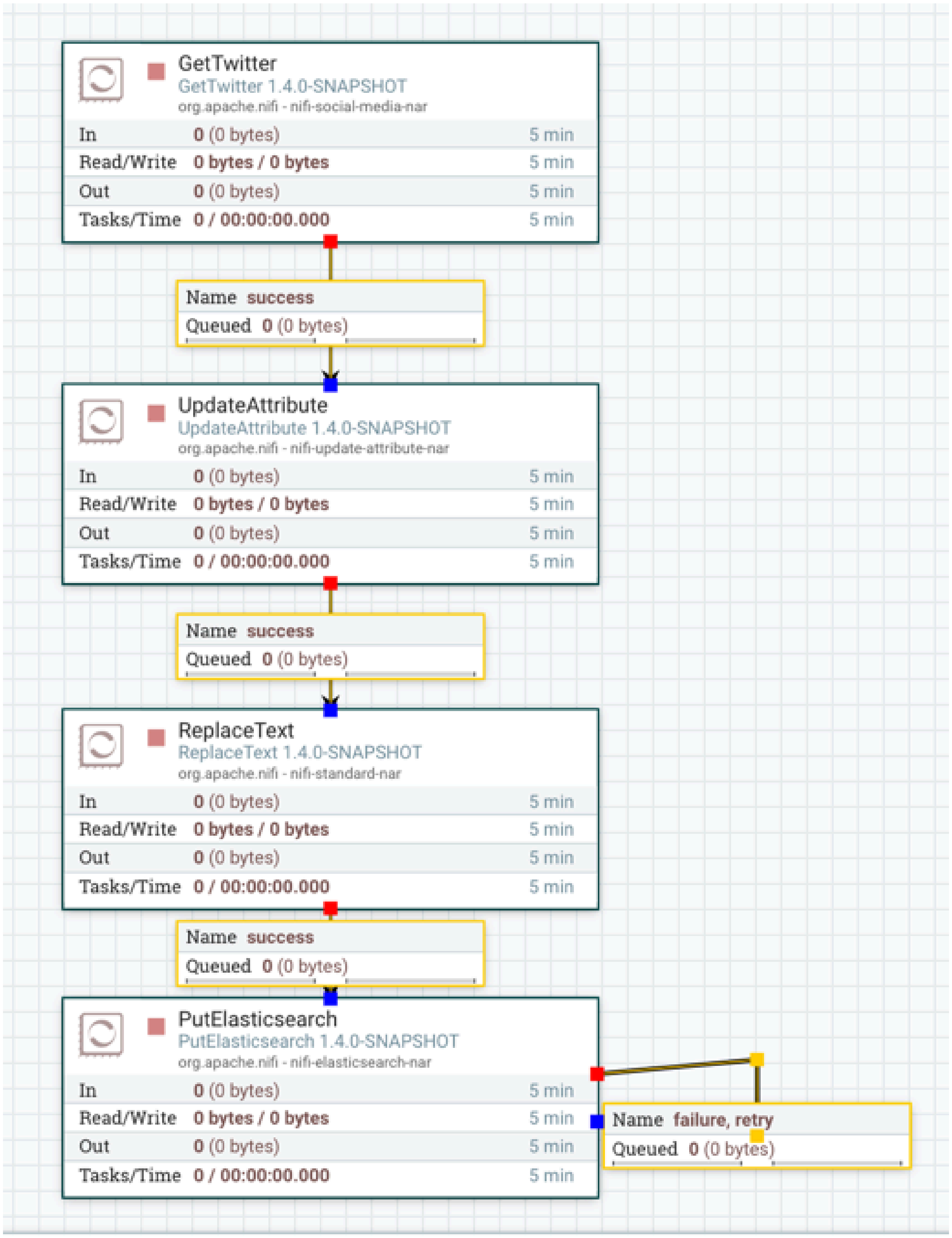
Components on the NiFi canvas can be aligned to more precisely arrange your dataflow. To do this, first select all the components you want to align. Then right-click to see the context menu and select "Align vertically" or "Align horizontally" depending on your desired result.

Align Vertically

Here is an example of aligning components vertically on your canvas. With all components selected/highlighted, right-click:


GetTwitter
GetTwitter 1.4.0-SNAPSHOT
org.apache.nifi - nifi-social-media-nar
In 0 (0 bytes) 5 min
Read/Write 0 bytes / 0 bytes 5 min
Out 0 (0 bytes) 5 min
Tasks/Time 0 / 00:00:00.000
Group
Copy
Delete
Align vertically
Align horizontally
Create template
Name success
Queued 0 (0 bytes)
UpdateAttribute
UpdateAttribute 1.4.0-SNAPSHOT
org.apache.nifi - nifi-update-attribute-nar
In 0 (0 bytes) 5 min
Read/Write 0 bytes / 0 bytes 5 min
Out 0 (0 bytes) 5 min
Tasks/Time 0 / 00:00:00.000 5 min
Name success
Queued 0 (0 bytes)
ReplaceText
ReplaceText 1.4.0-SNAPSHOT
org.apache.nifi - nifi-standard-nar
In 0 (0 bytes) 5 min
Read/Write 0 bytes / 0 bytes 5 min
Out 0 (0 bytes) 5 min
Tasks/Time 0 / 00:00:00.000 5 min
Name success
Queued 0 (0 bytes)
PutElasticsearch
PutElasticsearch 1.4.0-SNAPSHOT
org.apache.nifi - nifi-elasticsearch-nar
In 0 (0 bytes) 5 min
Read/Write 0 bytes / 0 bytes 5 min
Out 0 (0 bytes) 5 min
Tasks/Time 0 / 00:00:00.000 5 min
Name failure, retry
Queued 0 (0 bytes)

and select "Align vertically" to achieve these results:


GetTwitter
GetTwitter 1.4.0-SNAPSHOT
org.apache.nifi - nifi-social-media-nar

In	0 (0 bytes)	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 (0 bytes)	5 min
Tasks/Time	0 / 00:00:00.000	5 min

Name success
Queued 0 (0 bytes)

UpdateAttribute
UpdateAttribute 1.4.0-SNAPSHOT
org.apache.nifi - nifi-update-attribute-nar

In	0 (0 bytes)	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 (0 bytes)	5 min
Tasks/Time	0 / 00:00:00.000	5 min

Name success
Queued 0 (0 bytes)

ReplaceText
ReplaceText 1.4.0-SNAPSHOT
org.apache.nifi - nifi-standard-nar

In	0 (0 bytes)	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 (0 bytes)	5 min
Tasks/Time	0 / 00:00:00.000	5 min

Name success
Queued 0 (0 bytes)

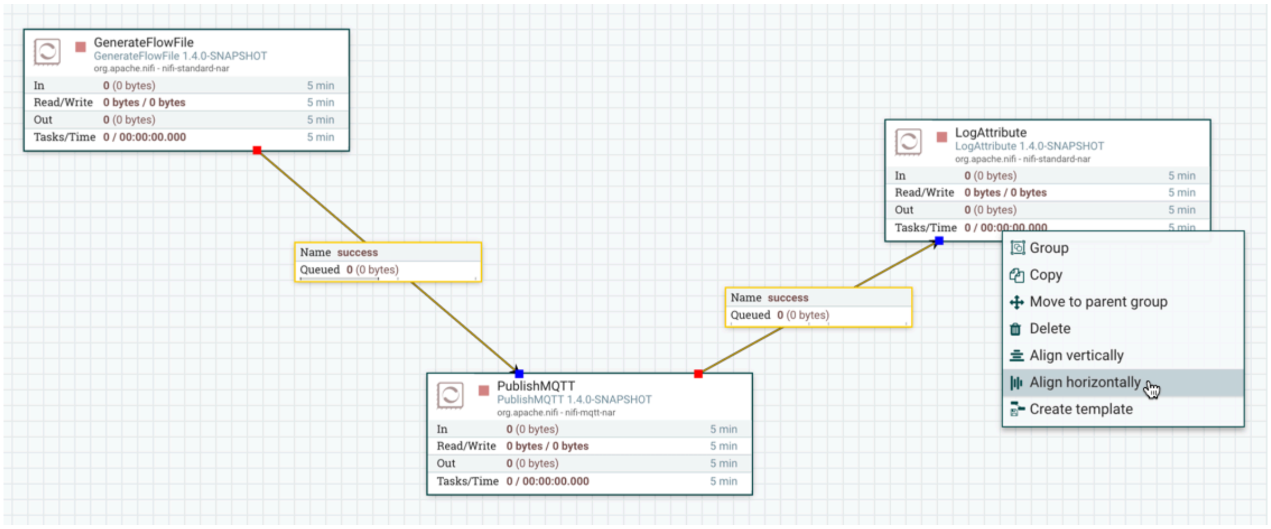
PutElasticsearch
PutElasticsearch 1.4.0-SNAPSHOT
org.apache.nifi - nifi-elasticsearch-nar

In	0 (0 bytes)	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 (0 bytes)	5 min
Tasks/Time	0 / 00:00:00.000	5 min

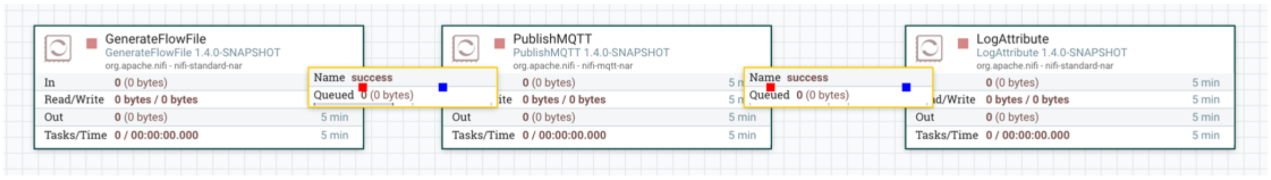
Name failure, retry
Queued 0 (0 bytes)

Align Horizontally

Here is an example of aligning components horizontally on your canvas. With all components selected/highlighted, right-click:



and select "Align horizontally" to achieve these results:



Search Components in DataFlow

NiFi UI provides searching functionality in order to help easily find components on the canvas. You can use search to find components by name, type, identifier, configuration properties, and their values. Search also makes it possible to refine and narrow the search result based on certain conditions using Filters and Keywords.

Filters

Filters can be added to the search box as key-value pairs where the keys are predefined and check certain conditions based on the given value. The syntax is "key:value".

Example 2: The search will be executed under Process Groups (directly or via contained Process Groups) containing the string "myGroup" in their name or id. The result will contain components that match for "processor1".

```
group:myGroup processor1
```

Filters can be used together with other search terms and multiple filters can be used. The only constraint is that the search must start with the filters. Unknown filters or known filters with unknown values are ignored. If the same filter key appears multiple times, the first will be used. The order of different filters has no effect on the result.

Example 3: Search will be restricted to the currently active process group (and process groups within that). The result will contain components that match for "import" but property matches will be excluded.

```
scope:here properties:exclude import
```

The supported filters are the following:

scope: This filter narrows the scope of the search based on the user's currently active Process Group. The only valid value is "here". The usage of this filter looks like "scope:here". Any other value is considered as invalid, thus the filter will be ignored during search.

group: This filter narrows the scope of the search based on the provided Process Group name or id. Search will be restricted to groups (and their components - including subgroups and their components) the names or ids of which match the filter value. If no group matches the filter, the result list will be empty.

properties: With this, users can prevent property matches to appear in the search result. Valid values are: "no", "none", "false", "exclude" and "0".

Keywords

Users can use pre-defined (case-insensitive) keywords in the search box that will check certain conditions.

Example 4: "disabled" will be treated both as keyword and regular search term. The result will contain disabled Ports and Processors as all other components that match for "disabled" in any way.

```
disabled
```

Keywords can be used with filters (see below) but not with other search terms (otherwise they won't be treated as keywords) and only one keyword can be used at a time. Note however that keywords will also be treated as general search terms at the same time.

Example 5: Search will be restricted to the currently selected process group (and its sub process groups). "invalid" here (as it is alone after the filter) will be treated both as a keyword and a regular search term. The result will contain invalid Processors and Ports as well as all other components that match for "invalid" in any way.

```
scope:here invalid
```

The supported keywords are the following:

- Scheduled state
  - disabled: Adds disabled Ports and Processors to the result list.
  - invalid: Adds Ports and Processors to the result list where the component is invalid.
  - running: Adds running Ports and Processors to the result list.
  - stopped: Adds stopped Ports and Processors to the result list.
  - validating: Adds Processors to the result list that are validating at the time.
- Scheduling strategy
  - event: Adds Processors to the result list where the Scheduling Strategy is "Event Driven".
  - timer: Adds Processors to the result list where the Scheduling Strategy is "Timer Driven".
- Execution
  - primary: Adds Processors to the result list that are set to run on the primary node only (whether if the Processor is currently running or not).
- Back pressure
  - back pressure: Adds Connections to the result list that are applying back pressure at the time.
  - pressure: See "back pressure".
- Expiration
  - expiration: Adds Connections to the result list that contain expired Flow Files.
  - expires: See "expiration".

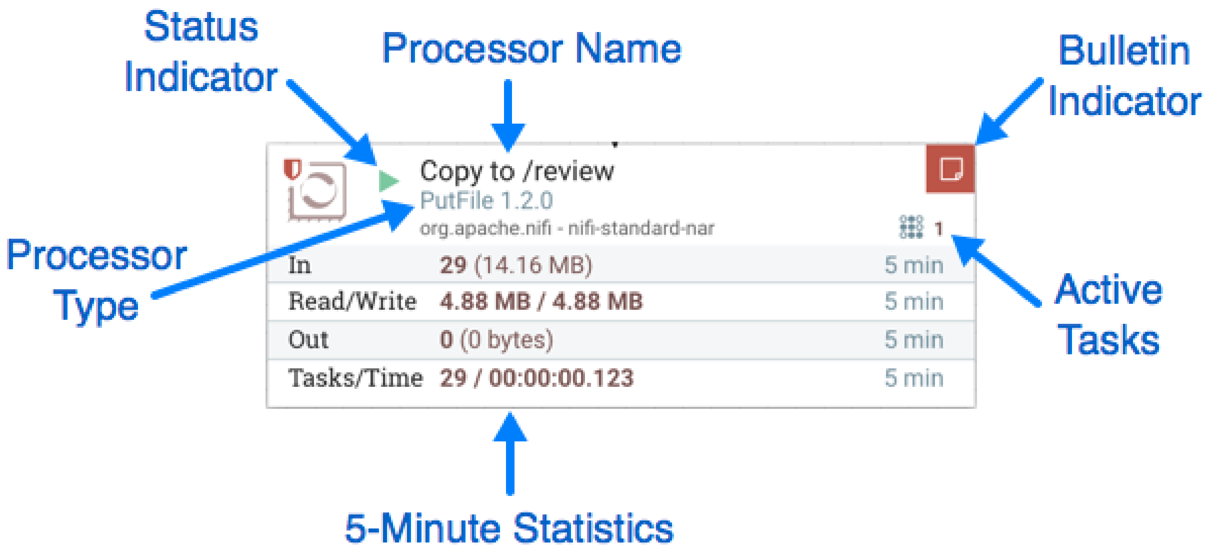
- Transmission
  - not transmitting: Adds Remote Process Groups to the result list that are not transmitting data at the time.
  - transmitting: Adds Remote Process Groups to the result list that are transmitting data at the time.
  - transmission disabled: See "not transmitting".
  - transmitting enabled: See "transmitting".

Monitoring of DataFlow

NiFi provides a great deal of information about the DataFlow in order to monitor its health and status. The Status bar provides information about the overall system health (see NiFi User Interface). Processors, Process Groups, and Remote Process Groups provide fine-grained details about their operations. Connections and Process Groups provide information about the amount of data in their queues. The Summary Page provides information about all of the components on the canvas in a tabular format and also provides System Diagnostics that include disk usage, CPU utilization, and Java Heap and Garbage Collection information. In a clustered environment, this information is available per-node or as aggregates across the entire cluster. We will explore each of these monitoring artifacts below.

Anatomy of a Processor

NiFi provides a significant amount of information about each Processor on the canvas. The following diagram shows the anatomy of a Processor:



The image outlines the following elements:

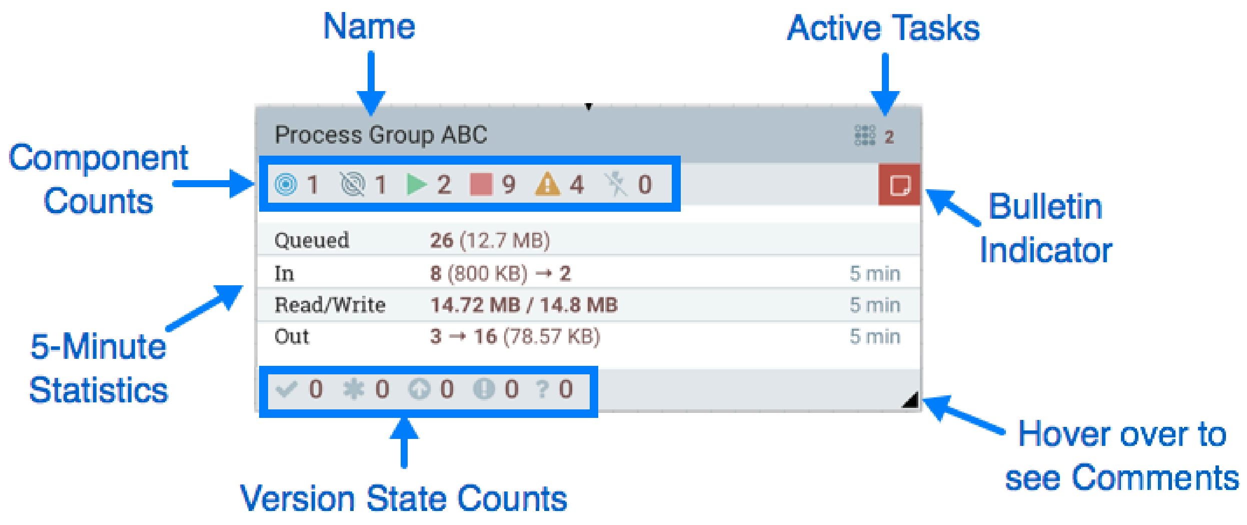
- Processor Type: NiFi provides several different types of Processors in order to allow for a wide range of tasks to be performed. Each type of Processor is designed to perform one specific task. The Processor type (PutFile, in this example) describes the task that this Processor performs. In this case, the Processor writes a FlowFile to disk - or "Puts" a FlowFile to a File.
- Bulletin Indicator: When a Processor logs that some event has occurred, it generates a Bulletin to notify those who are monitoring NiFi via the User Interface. The DFM is able to configure which bulletins should be displayed in the User Interface by updating the "Bulletin level" field in the "Settings" tab of the Processor configuration dialog. The default value is WARN, which means that only warnings and errors will be displayed in the UI. This icon is not present unless a Bulletin exists for this Processor. When it is present, hovering over the icon with the mouse will provide a tooltip explaining the message provided by the Processor as well as the Bulletin level. If the

instance of NiFi is clustered, it will also show the Node that emitted the Bulletin. Bulletins automatically expire after five minutes.

- Status Indicator: Shows the current Status of the Processor. The following indicators are possible:
  - ▶ Running: The Processor is currently running.
  - ■ Stopped: The Processor is valid and enabled but is not running.
  - ⚠ Invalid: The Processor is enabled but is not currently valid and cannot be started. Hovering over this icon will provide a tooltip indicating why the Processor is not valid.
  - Disabled: The Processor is not running and cannot be started until it has been enabled. This status does not indicate whether or not the Processor is valid.
- Processor Name: This is the user-defined name of the Processor. By default, the name of the Processor is the same as the Processor Type. In the example, this value is "Copy to /review".
- Active Tasks: The number of tasks that this Processor is currently executing. This number is constrained by the "Concurrent tasks" setting in the "Scheduling" tab of the Processor configuration dialog. Here, we can see that the Processor is currently performing one task. If the NiFi instance is clustered, this value represents the number of tasks that are currently executing across all nodes in the cluster.
- 5-Minute Statistics: The Processor shows several different statistics in tabular form. Each of these statistics represents the amount of work that has been performed in the past five minutes. If the NiFi instance is clustered, these values indicate how much work has been done by all of the Nodes combined in the past five minutes. These metrics are:
  - In: The amount of data that the Processor has pulled from the queues of its incoming Connections. This value is represented as <count> (<size>) where <count> is the number of FlowFiles that have been pulled from the queues and <size> is the total size of those FlowFiles' content. In this example, the Processor has pulled 29 FlowFiles from the input queues, for a total of 14.16 megabytes (MB).
  - Read/Write: The total size of the FlowFile content that the Processor has read from disk and written to disk. This provides valuable information about the I/O performance that this Processor requires. Some Processors may only read the data without writing anything while some will not read the data but will only write data. Others will neither read nor write data, and some Processors will both read and write data. In this example, we see that in the past five minutes, this Processor has read 4.88 MB of the FlowFile content and has written 4.88 MB as well. This is what we would expect, since this Processor simply copies the contents of a FlowFile to disk. Note, however, that this is not the same as the amount of data that it pulled from its input queues. This is because some of the files that it pulled from the input queues already exist in the output directory, and the Processor is configured to route FlowFiles to failure when this occurs. Therefore, for those files which already existed in the output directory, data was neither read nor written to disk.
  - Out: The amount of data that the Processor has transferred to its outbound Connections. This does not include FlowFiles that the Processor removes itself, or FlowFiles that are routed to connections that are auto-terminated. Like the "In" metric above, this value is represented as <count> (<size>) where <count> is the number of FlowFiles that have been transferred to outbound Connections and <size> is the total size of those FlowFiles' content. In this example, all of the Relationships are configured to be auto-terminated, so no FlowFiles are reported as having been transferred Out.
  - Tasks/Time: The number of times that this Processor has been triggered to run in the past 5 minutes, and the amount of time taken to perform those tasks. The format of the time is <hour>:<minute>:<second>. Note that the amount of time taken can exceed five minutes, because many tasks can be executed in parallel. For instance, if the Processor is scheduled to run with 60 Concurrent tasks, and each of those tasks takes one second to complete, it is possible that all 60 tasks will be completed in a single second. However, in this case we will see the Time metric showing that it took 60 seconds, instead of 1 second. This time can be thought of as "System Time," or said another way, this value is 60 seconds because that's the amount of time it would have taken to perform the action if only a single concurrent task were used.

Anatomy of a Process Group

The Process Group provides a mechanism for grouping components together into a logical construct in order to organize the DataFlow in a way that makes it more understandable from a higher level. The following image highlights the different elements that make up the anatomy of a Process Group:



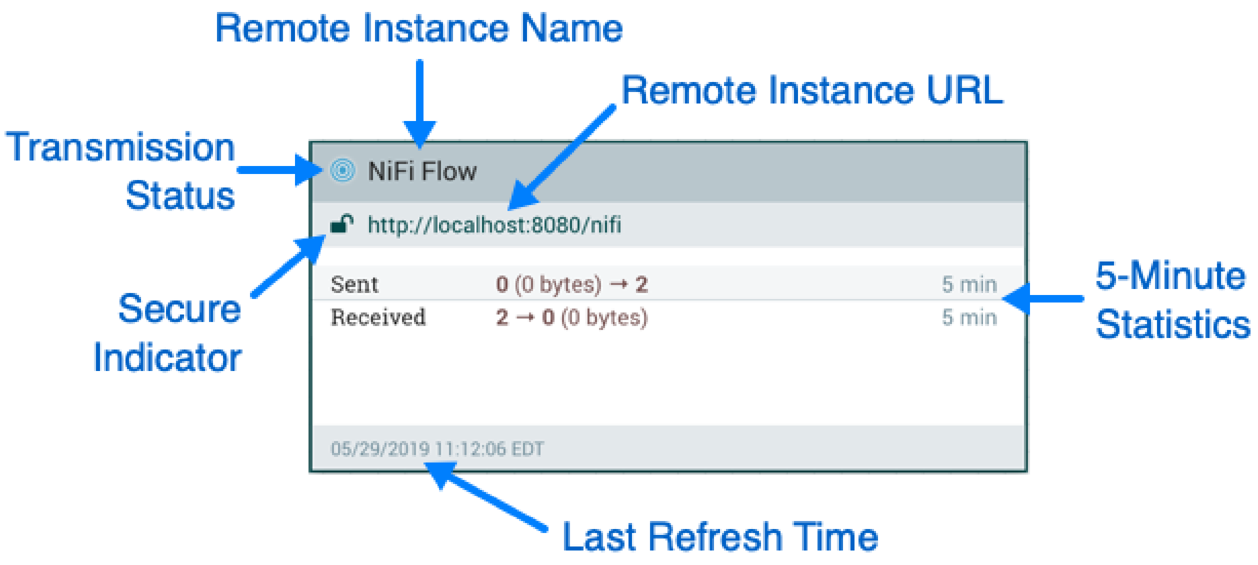
The Process Group consists of the following elements:

- Name: This is the user-defined name of the Process Group. This name is set when the Process Group is added to the canvas. The name can later by changed by right-clicking on the Process Group and clicking the "Configure" menu option. In this example, the name of the Process Group is "Process Group ABC."
- Bulletin Indicator: When a child component of a Process Group emits a bulletin, that bulletin is propagated to the component's parent Process Group, as well. When any component has an active Bulletin, this indicator will appear, allowing the user to hover over the icon with the mouse to see the Bulletin.
- Active Tasks: The number of tasks that are currently executing by the components within this Process Group. Here, we can see that the Process Group is currently performing two tasks. If the NiFi instance is clustered, this value represents the number of tasks that are currently executing across all nodes in the cluster.
- Statistics: Process Groups provide statistics about the amount of data that has been processed by the Process Group in the past 5 minutes as well as the amount of data currently enqueued within the Process Group. The following elements comprise the "Statistics" portion of a Process Group:
  - Queued: The number of FlowFiles currently enqueued within the Process Group. This field is represented as <count> (<size>) where <count> is the number of FlowFiles that are currently enqueued in the Process Group and <size> is the total size of those FlowFiles' content. In this example, the Process Group currently has 26 FlowFiles enqueued with a total size of 12.7 megabytes (MB).
  - In: The number of FlowFiles that have been transferred into the Process Group through all of its Input Ports over the past 5 minutes. This field is represented as <count> / <size> # <ports> where <count> is the number of FlowFiles that have entered the Process Group in the past 5 minutes, <size> is the total size of those FlowFiles' content and <ports> is the number of Input Ports. In this example, 8 FlowFiles have entered the Process Group with a total size of 800 KB and two Input Ports exist.
  - Read/Write: The total size of the FlowFile content that the components within the Process Group have read from disk and written to disk. This provides valuable information about the I/O performance that this Process Group requires. In this example, we see that in the past five minutes, components within this Process Group have read 14.72 MB of the FlowFile content and have written 14.8 MB.

    - Out: The number of FlowFiles that have been transferred out of the Process Group through its Output Ports over the past 5 minutes. This field is represented as <ports> # <count> (<size>) where <ports> is the number of Output Ports, <count> is the number of FlowFiles that have exited the Process Group in the past 5 minutes and <size> is the total size of those FlowFiles' content. In this example, there are three Output Ports, 16 FlowFiles have exited the Process Group and their total size is 78.57 KB.
- Component Counts: The Component Counts element provides information about how many components of each type exist within the Process Group. The following provides information about each of these icons and their meanings:
    - Transmitting Ports: The number of Remote Process Group Ports that currently are configured to transmit data to remote instances of NiFi or pull data from remote instances of NiFi.
    - Non-Transmitting Ports: The number of Remote Process Group Ports that are currently connected to components within this Process Group but currently have their transmission disabled.
    - Running Components: The number of Processors, Input Ports, and Output Ports that are currently running within this Process Group.
    - Stopped Components: The number of Processors, Input Ports, and Output Ports that are currently not running but are valid and enabled. These components are ready to be started.
    - Invalid Components: The number of Processors, Input Ports, and Output Ports that are enabled but are currently not in a valid state. This may be due to misconfigured properties or missing Relationships.
    - Disabled Components: The number of Processors, Input Ports, and Output Ports that are currently disabled. These components may or may not be valid. If the Process Group is started, these components will not cause any errors but will not be started.
- Version State Counts: The Version State Counts element provides information about how many versioned process groups are within the Process Group. See Version States for more information.
- Comments: When the Process Group is added to the canvas, the user is given the option of specifying Comments in order to provide information about the Process Group. The comments can later be changed by right-clicking on the Process Group and clicking the "Configure" menu option.

Anatomy of a Remote Process Group

When creating a DataFlow, it is often necessary to transfer data from one instance of NiFi to another. In this case, the remote instance of NiFi can be thought of as a Process Group. For this reason, NiFi provides the concept of a Remote Process Group. From the User Interface, the Remote Process Group looks similar to the Process Group. However, rather than showing information about the inner workings and state of a Remote Process Group, such as queue sizes, the information rendered about a Remote Process Group is related to the interaction that occurs between this instance of NiFi and the remote instance.



NiFi Flow

http://localhost:8080/nifi

Sent	0 (0 bytes) → 2	5 min
Received	2 → 0 (0 bytes)	5 min

05/29/2019 11:12:06 EDT

The image above shows the different elements that make up a Remote Process Group. Here, we provide an explanation of the icons and details about the information provided.

- Transmission Status: The Transmission Status indicates whether or not data Transmission between this instance of NiFi and the remote instance is currently enabled. The icon shown will be the Transmission Enabled icon ( ) if any of the Input Ports or Output Ports is currently configured to transmit or the Transmission Disabled icon ( ) if all of the Input Ports and Output Ports that are currently connected are stopped.
- Remote Instance Name: This is the name of the NiFi instance that was reported by the remote instance. When the Remote Process Group is first created, before this information has been obtained, the URL(s) of the remote instance will be shown here instead.
- Remote Instance URL: This is the URL of the remote instance that the Remote Process Group points to. This URL is entered when the Remote Process Group is added to the canvas and it cannot be changed.
- Secure Indicator: This icon indicates whether or not communications with the remote NiFi instance are secure. If communications with the remote instance are secure, this will be indicated by the "Locked" icon ( ). If the communications are not secure, this will be indicated by the "Unlocked" icon ( ). If the communications are secure, this instance of NiFi will not be able to communicate with the remote instance until an administrator for the remote instance grants access. Whenever the Remote Process Group is added to the canvas, this will automatically initiate a request to have a user for this instance of NiFi created on the remote instance. This instance will be unable to communicate with the remote instance until an administrator on the remote instance adds the user to the system and adds the "NiFi" role to the user. In the event that communications are not secure, the Remote Process Group is able to receive data from anyone, and the data is not encrypted while it is transferred between instances of NiFi.
- 5-Minute Statistics: Two statistics are shown for Remote Process Groups: Sent and Received. Both of these are in the format <count> (<size>) where <count> is the number of FlowFiles that have been sent or received in the previous five minutes and <size> is the total size of those FlowFiles' content.
- Last Refresh Time: The information that is pulled from a remote instance and rendered on the Remote Process Group in the User Interface is periodically refreshed in the background. This element indicates the time at which that refresh last happened, or if the information has not been refreshed for a significant amount of time, the value will change to indicate Remote flow not current. NiFi can be triggered to initiate a refresh of this information by right-clicking on the Remote Process Group and choosing the "Refresh remote" menu item.

Queue Interaction

The FlowFiles enqueued in a Connection can be viewed when necessary. The Queue listing is opened via List que ue in a Connection's context menu. The listing will return the top 100 FlowFiles in the active queue according to the configured priority. The listing can be performed even if the source and destination are actively running.

Additionally, details for a Flowfile in the listing can be viewed by clicking the "Details" button ( ) in the left most column. From here, the FlowFile details and attributes are available as well as buttons for downloading or viewing the content. Viewing the content is only available if the nifi.content.viewer.url has been configured. If the source or destination of the Connection are actively running, there is a chance that the desired FlowFile will no longer be in the active queue.

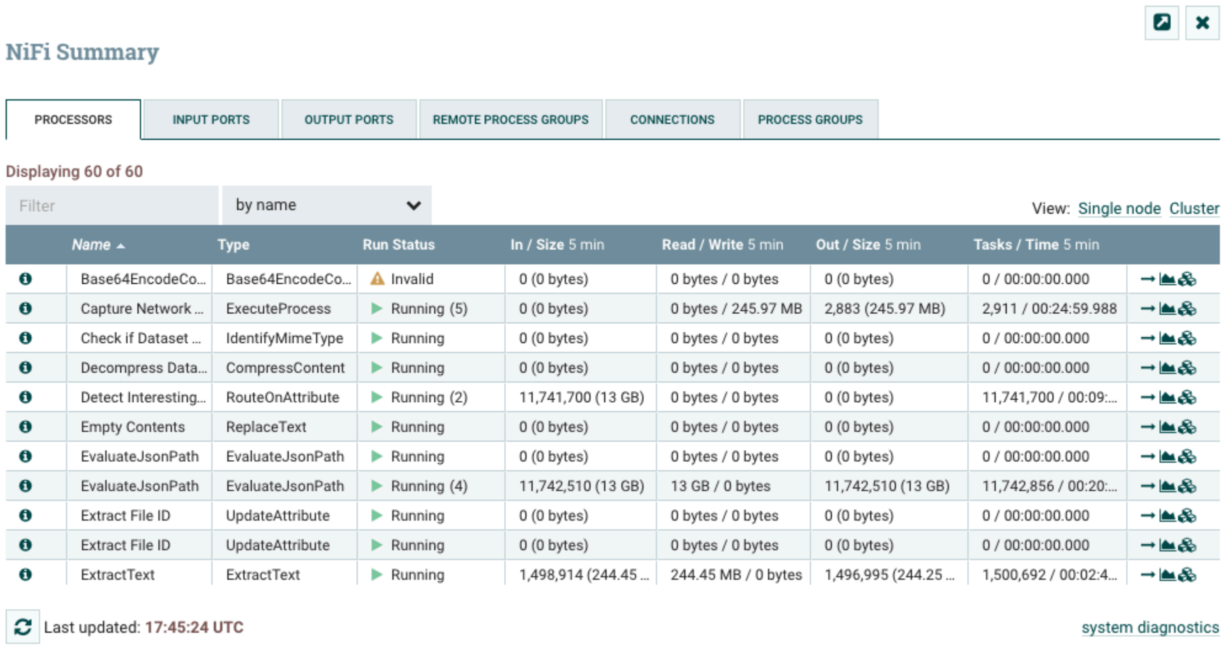
The FlowFiles enqueued in a Connection can also be deleted when necessary. The removal of the FlowFiles is initiated via Empty queue in the Connection's context menu. This action can also be performed if the source and destination are actively running.

If the analytics prediction feature is enabled, hovering over the queue will also reveal predicted statistics on when the queue may encounter back pressure, either due to the object count or content size meeting the current threshold settings. Predictions will only be available when NiFi has enough data in its internal repository and if its model is accurate enough to broadcast a prediction. For more information, see the Analytics Framework section in the System Administrator's Guide.

Summary Page

While the NiFi canvas is useful for understanding how the configured DataFlow is laid out, this view is not always optimal when trying to discern the status of the system. In order to help the user understand how the DataFlow is functioning at a higher level, NiFi provides a Summary page. This page is available in the Global Menu in the top-right corner of the User Interface. See the NiFi User Interface section for more information about the location of this toolbar.

The Summary Page is opened by selecting Summary from the Global Menu. This opens the Summary table dialog:



NiFi Summary

Displaying 60 of 60

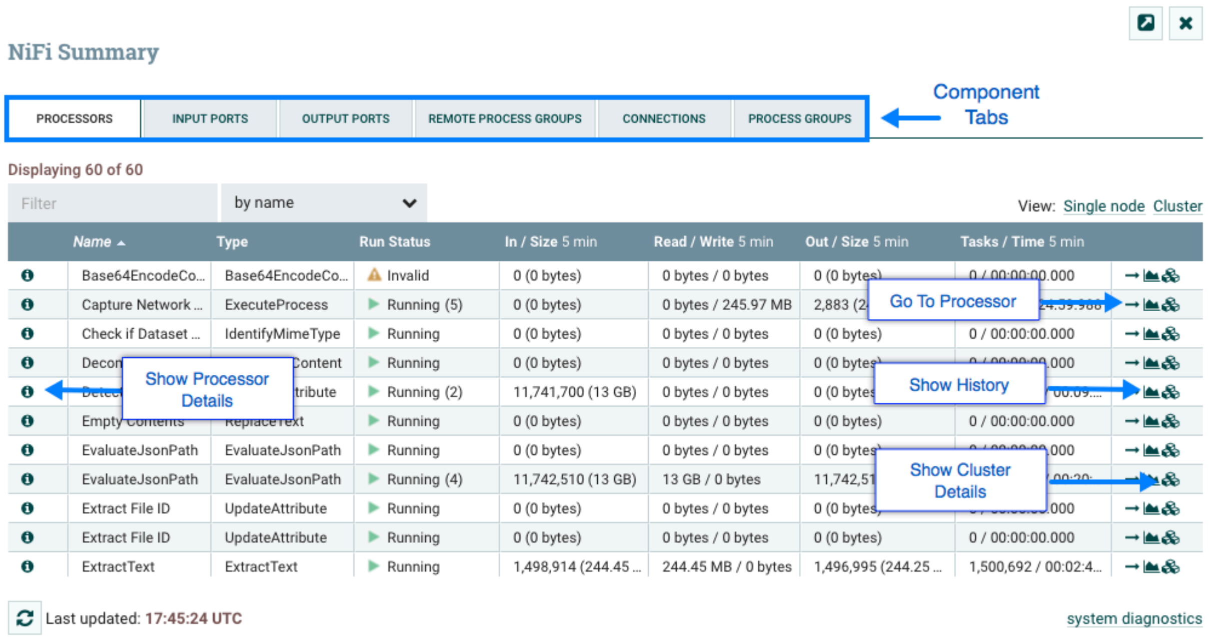
Filter | by name | View: Single node Cluster

	Name ▲	Type	Run Status	In / Size 5 min	Read / Write 5 min	Out / Size 5 min	Tasks / Time 5 min	
●	Base64EncodeCo...	Base64EncodeCo...	⚠ Invalid	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000	→
●	Capture Network ...	ExecuteProcess	▶ Running (5)	0 (0 bytes)	0 bytes / 245.97 MB	2,883 (245.97 MB)	2,911 / 00:24:59.988	→
●	Check if Dataset ...	IdentifyMimeType	▶ Running	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000	→
●	Decompress Data...	CompressContent	▶ Running	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000	→
●	Detect Interesting...	RouteOnAttribute	▶ Running (2)	11,741,700 (13 GB)	0 bytes / 0 bytes	0 (0 bytes)	11,741,700 / 00:09:...	→
●	Empty Contents	ReplaceText	▶ Running	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000	→
●	EvaluateJsonPath	EvaluateJsonPath	▶ Running	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000	→
●	EvaluateJsonPath	EvaluateJsonPath	▶ Running (4)	11,742,510 (13 GB)	13 GB / 0 bytes	11,742,510 (13 GB)	11,742,856 / 00:20:...	→
●	Extract File ID	UpdateAttribute	▶ Running	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000	→
●	Extract File ID	UpdateAttribute	▶ Running	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000	→
●	ExtractText	ExtractText	▶ Running	1,498,914 (244.45 ...	244.45 MB / 0 bytes	1,496,995 (244.25 ...	1,500,692 / 00:02:4...	→

Last updated: 17:45:24 UTC

system diagnostics

This dialog provides a great deal of information about each of the components on the canvas. Below, we have annotated the different elements within the dialog in order to make the discussion of the dialog easier.



Displaying 60 of 60

Filter | by name | View: Single node Cluster

	Name	Type	Run Status	In / Size 5 min	Read / Write 5 min	Out / Size 5 min	Tasks / Time 5 min	
ℹ	Base64EncodeCo...	Base64EncodeCo...	⚠ Invalid	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000	→
ℹ	Capture Network ...	ExecuteProcess	▶ Running (5)	0 (0 bytes)	0 bytes / 245.97 MB	2,883 (2	24:39.988	→
ℹ	Check if Dataset ...	IdentifyMimeType	▶ Running	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000	→
ℹ	Decon	Content	▶ Running	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000	→
ℹ	Detec	tribute	▶ Running (2)	11,741,700 (13 GB)	0 bytes / 0 bytes	0 (0 bytes	00:09....	→
ℹ	Empty Contents	ReplaceText	▶ Running	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000	→
ℹ	EvaluateJsonPath	EvaluateJsonPath	▶ Running	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000	→
ℹ	EvaluateJsonPath	EvaluateJsonPath	▶ Running (4)	11,742,510 (13 GB)	13 GB / 0 bytes	11,742,51	/ 00:20:	→
ℹ	Extract File ID	UpdateAttribute	▶ Running	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000	→
ℹ	Extract File ID	UpdateAttribute	▶ Running	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 / 00:00:00.000	→
ℹ	ExtractText	ExtractText	▶ Running	1,498,914 (244.45 ...	244.45 MB / 0 bytes	1,496,995 (244.25 ...	1,500,692 / 00:02:4...	→

Last updated: 17:45:24 UTC

The Summary page is primarily comprised of a table that provides information about each of the components on the canvas. Above this table is a set of five tabs that can be used to view the different types of components. The information provided in the table is the same information that is provided for each component on the canvas. Each of the columns in the table may be sorted by clicking on the heading of the column. For more on the types of information displayed, see the sections Anatomy of a Processor, Anatomy of a Process Group, and Anatomy of a Remote Process Group above.

The Summary page also includes the following elements:

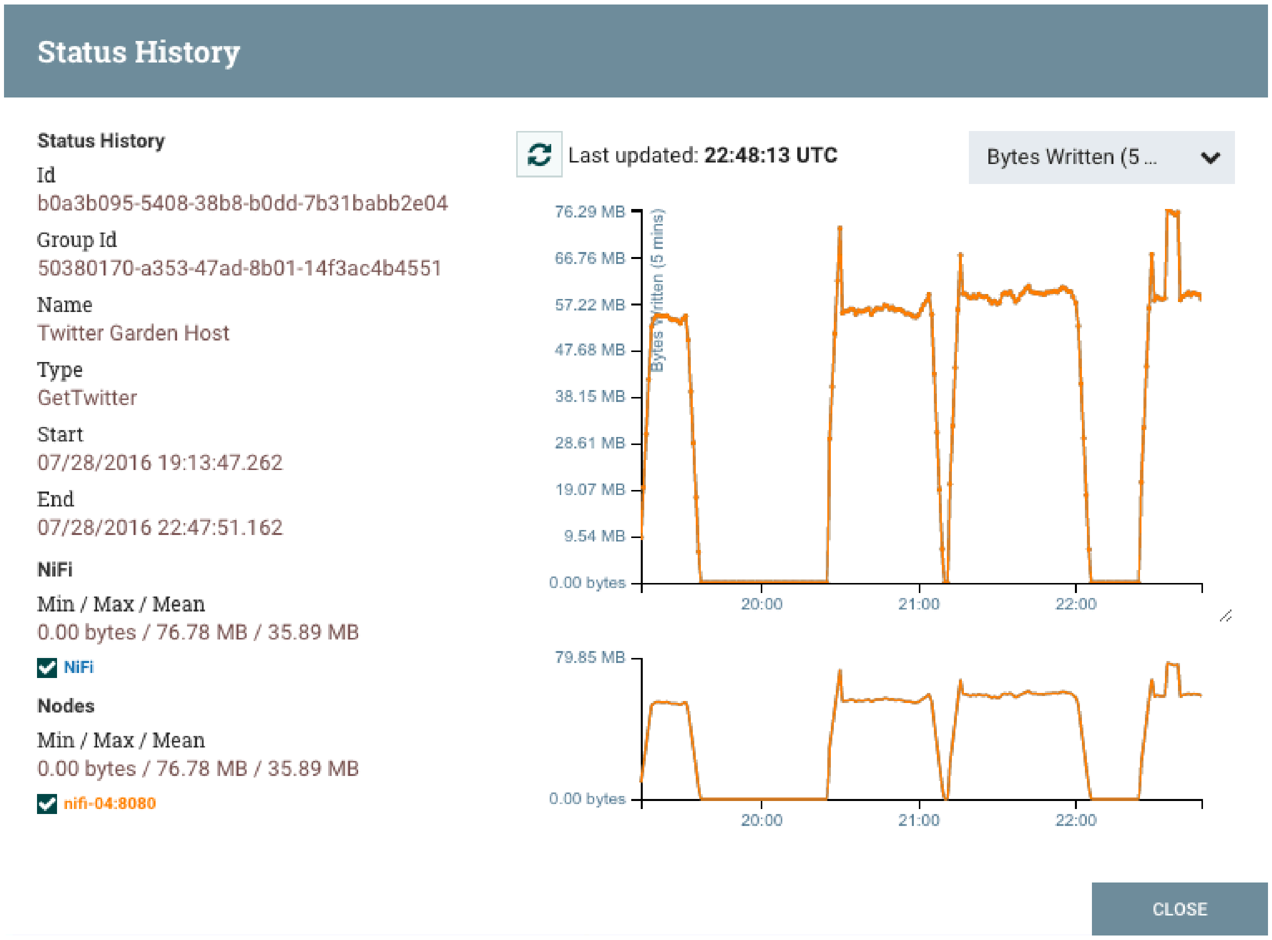
- Bulletin Indicator: As in other places throughout the User Interface, when this icon is present, hovering over the icon will provide information about the Bulletin that was generated, including the message, the severity level, the time at which the Bulletin was generated, and (in a clustered environment) the node that generated the Bulletin. Like all the columns in the Summary table, this column where bulletins are shown may be sorted by clicking on the heading so that all the currently existing bulletins are shown at the top of the list.
- Details: Clicking the Details icon will provide the user with the details of the component. This dialog is the same as the dialog provided when the user right-clicks on the component and chooses the "View Configuration" menu item.
- Go To: Clicking this button will close the Summary page and take the user directly to the component on the NiFi canvas. This may change the Process Group that the user is currently in. This icon is not available if the Summary page has been opened in a new browser tab or window (by clicking the "Pop Out" button, as described below).
- Status History: Clicking the Status History icon will open a new dialog that shows a historical view of the statistics that are rendered for this component. See the section Historical Statistics of a Component for more information.
- Refresh: The "Refresh" button allows the user to refresh the information displayed without closing the dialog and opening it again. The time at which the information was last refreshed is shown just to the right of the "Refresh" button. The information on the page is not automatically refreshed.
- Filter: The Filter element allows users to filter the contents of the Summary table by typing in all or part of some criteria, such as a Processor Type or Processor Name. The types of filters available differ according to the selected tab. For instance, if viewing the Processor tab, the user is able to filter by name or by type. When viewing the Connections tab, the user is able to filter by source, by name, or by destination name. The filter is automatically applied when the contents of the text box are changed. Below the text box is an indicator of how many entries in the table match the filter and how many entries exist in the table.

- Pop-Out: When monitoring a flow, it is helpful to be able to open the Summary table in a separate browser tab or window. The "Pop Out" button, next to the "Close" button, will cause the entire Summary dialog to be opened in a new browser tab or window (depending on the configuration of the browser). Once the page is "popped out", the dialog is closed in the original browser tab/window. In the new tab/window, the "Pop Out" button and the "Go To" button will no longer be available.
- System Diagnostics: The System Diagnostics window provides information about how the system is performing with respect to system resource utilization. While this is intended mostly for administrators, it is provided in this view because it does provide a summary of the system. This dialog shows information such as CPU utilization, how full the disks are, and Java-specific metrics, such as memory size and utilization, as well as Garbage Collection information.

Historical Statistics of a Component

While the Summary table and the canvas show numeric statistics pertaining to the performance of a component over the past five minutes, it is often useful to have a view of historical statistics as well. This information is available by right-clicking on a component and choosing the "Status History" menu option or by clicking on the Status History in the Summary page (see Summary Page for more information).

The amount of historical information that is stored is configurable in the NiFi properties but defaults to 24 hours. For specific configuration information reference the Component Status Repository of the System Administrator's Guide. When the Status History dialog is opened, it provides a graph of historical statistics:


Status History

Status History
Id
b0a3b095-5408-38b8-b0dd-7b31babb2e04
Group Id
50380170-a353-47ad-8b01-14f3ac4b4551
Name
Twitter Garden Host
Type
GetTwitter
Start
07/28/2016 19:13:47.262
End
07/28/2016 22:47:51.162
NiFi
Min / Max / Mean
0.00 bytes / 76.78 MB / 35.89 MB
✓ NiFi
Nodes
Min / Max / Mean
0.00 bytes / 76.78 MB / 35.89 MB
✓ nifi-04:8080

Last updated: **22:48:13 UTC**

The left-hand side of the dialog provides information about the component that the stats are for, as well as a textual representation of the statistics being graphed. The following information is provided on the left-hand side:

- Id: The ID of the component for which the stats are being shown.

- Group Id: The ID of the Process Group in which the component resides.
- Name: The Name of the Component for which the stats are being shown.
- Component-Specific Entries: Information is shown for each different type of component. For example, for a Processor, the type of Processor is displayed. For a Connection, the source and destination names and IDs are shown.
- Start: The earliest time shown on the graph.
- End: The latest time shown on the graph.
- Min/Max/Mean: The minimum, maximum, and mean (arithmetic mean, or average) values are shown. These values are based only on the range of time selected, if any time range is selected. If this instance of NiFi is clustered, these values are shown for the cluster as a whole, as well as each individual node. In a clustered environment, each node is shown in a different color. This also serves as the graph's legend, showing the color of each node that is shown in the graph. Hovering the mouse over the Cluster or one of the nodes in the legend will also make the corresponding node bold in the graph.

The right-hand side of the dialog provides a drop-down list of the different types of metrics to render in the graphs below. The top graph is larger so as to provide an easier-to-read rendering of the information. In the bottom-right corner of this graph is a small handle ( ) that can be dragged to resize the graph. The blank areas of the dialog can also be dragged around to move the entire dialog.

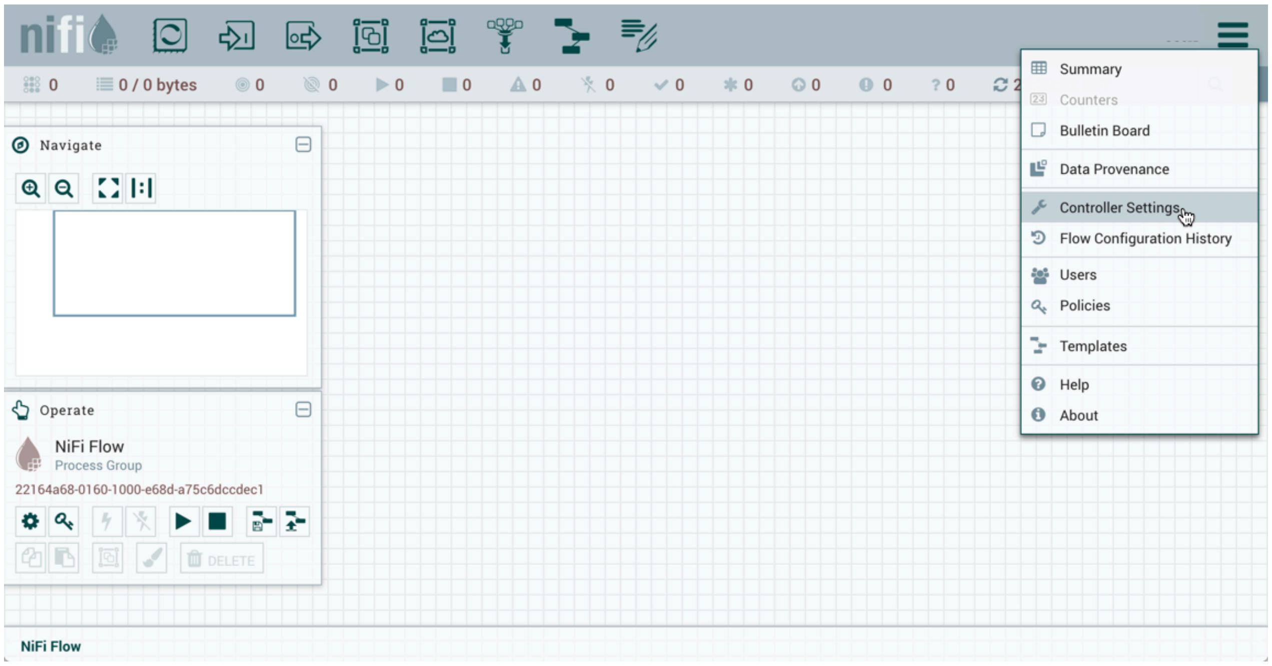
The bottom graph is much shorter and provides the ability to select a time range. Selecting a time range here will cause the top graph to show only the time range selected, but in a more detailed manner. Additionally, this will cause the Min/Max/Mean values on the left-hand side to be recalculated. Once a selection has been created by dragging a rectangle over the graph, double-clicking on the selected portion will cause the selection to fully expand in the vertical direction (i.e., it will select all values in this time range). Clicking on the bottom graph without dragging will remove the selection.

Versioning a DataFlow

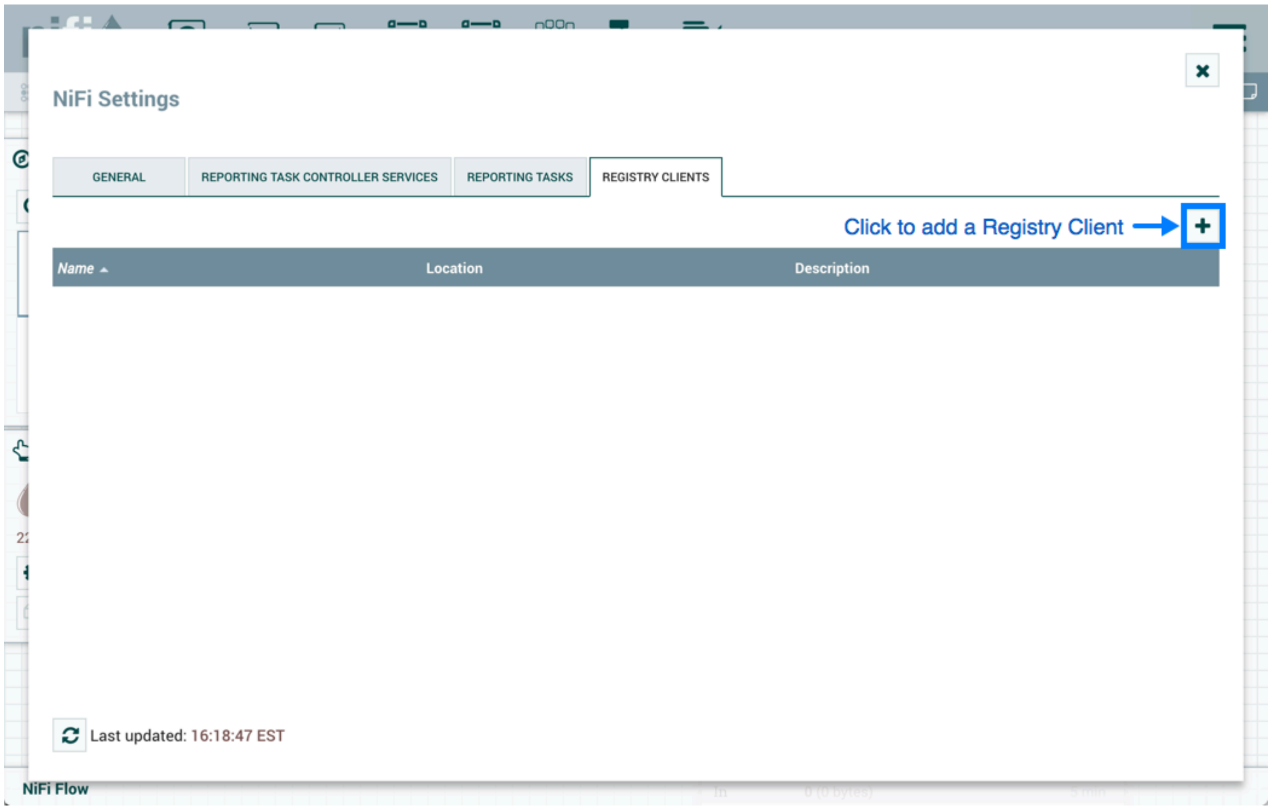
When NiFi is connected to a NiFi Registry, dataflows can be version controlled on the process group level. For more information about NiFi Registry usage and configuration, see the documentation at https://nifi.apache.org/docs/nifi-registry-docs/index.html.

Connecting to a NiFi Registry

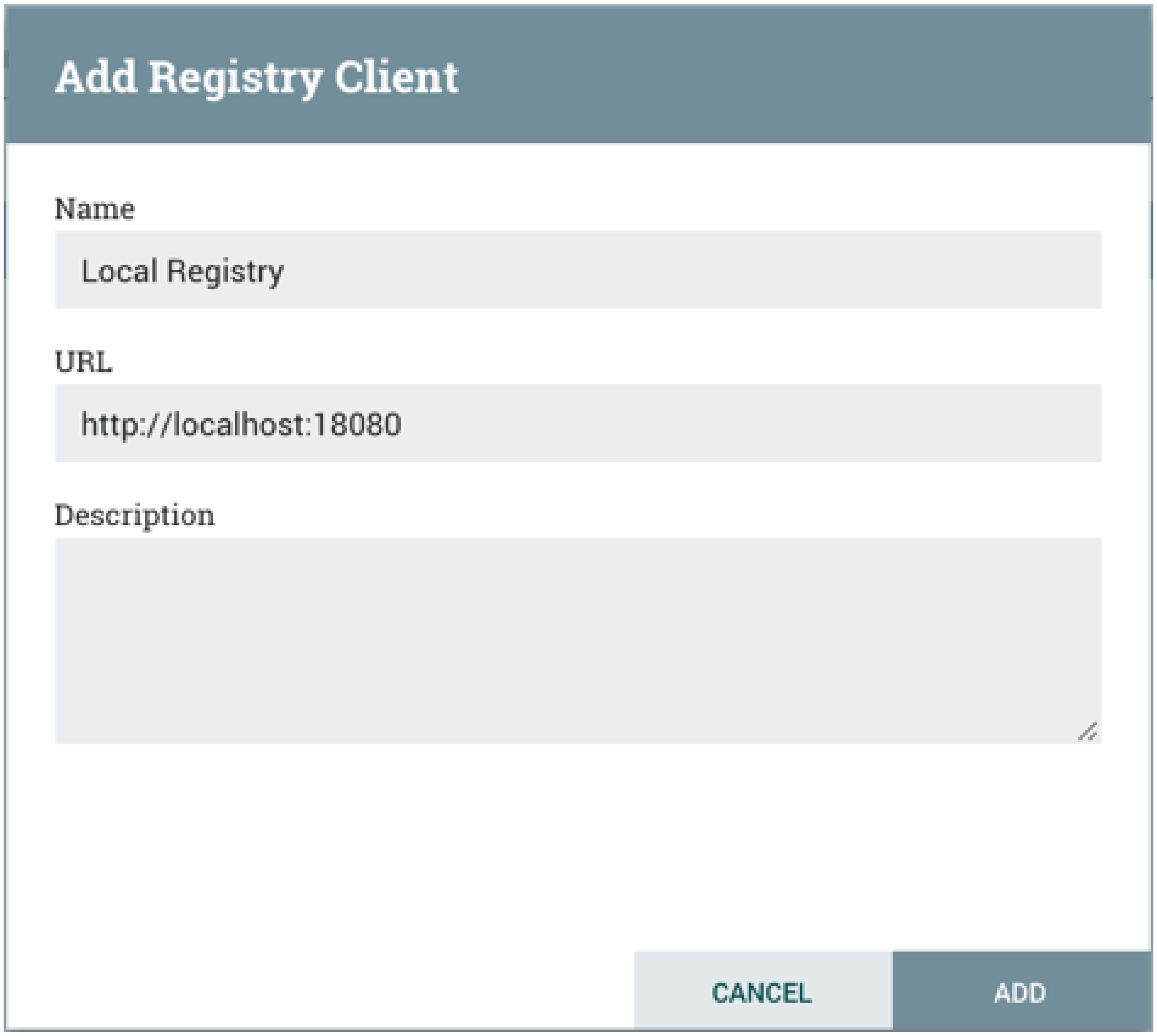
To connect NiFi to a Registry, select Controller Settings from the Global Menu.



This displays the NiFi Settings window. Select the Registry Clients tab and click the + button in the upper-right corner to register a new Registry client.


NiFi Settings
GENERAL
REPORTING TASK CONTROLLER SERVICES
REPORTING TASKS
REGISTRY CLIENTS
Click to add a Registry Client
Name
Location
Description
Last updated: 16:18:47 EST
NiFi Flow

In the Add Registry Client window, provide a name and URL.

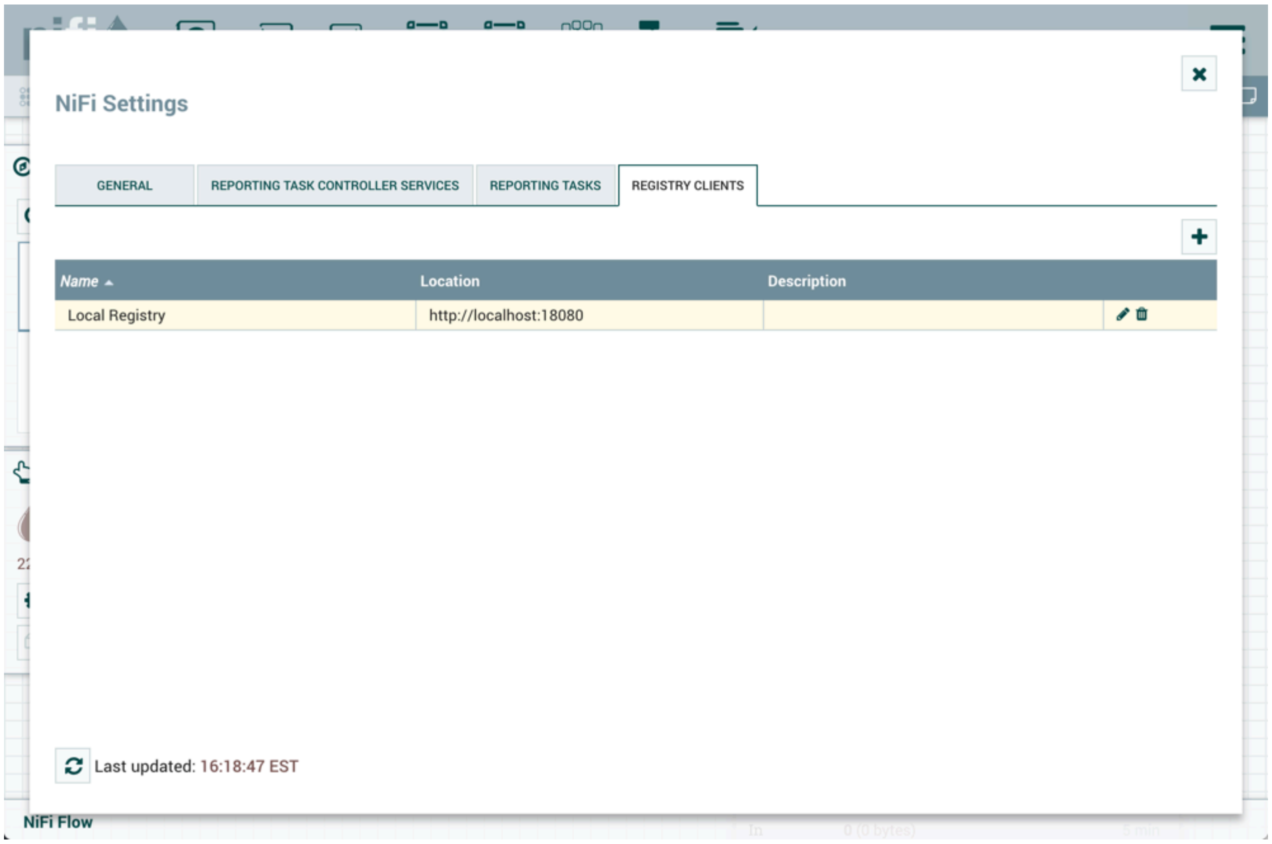


Name: Local Registry

URL: http://localhost:18080

Description:

Click "Add" to complete the registration.



Name	Location	Description
Local Registry	http://localhost:18080	

Last updated: 16:18:47 EST

Note: Versioned flows are stored and organized in registry buckets. Bucket Policies and Special Privileges configured by the registry administrator determine which buckets a user can import versioned flows from and which buckets a user can save versioned flows to. Information on Bucket Policies and Special Privileges can be found in the NiFi Registry User Guide (https://nifi.apache.org/docs/nifi-registry-docs/html/user-guide.html).

Version States

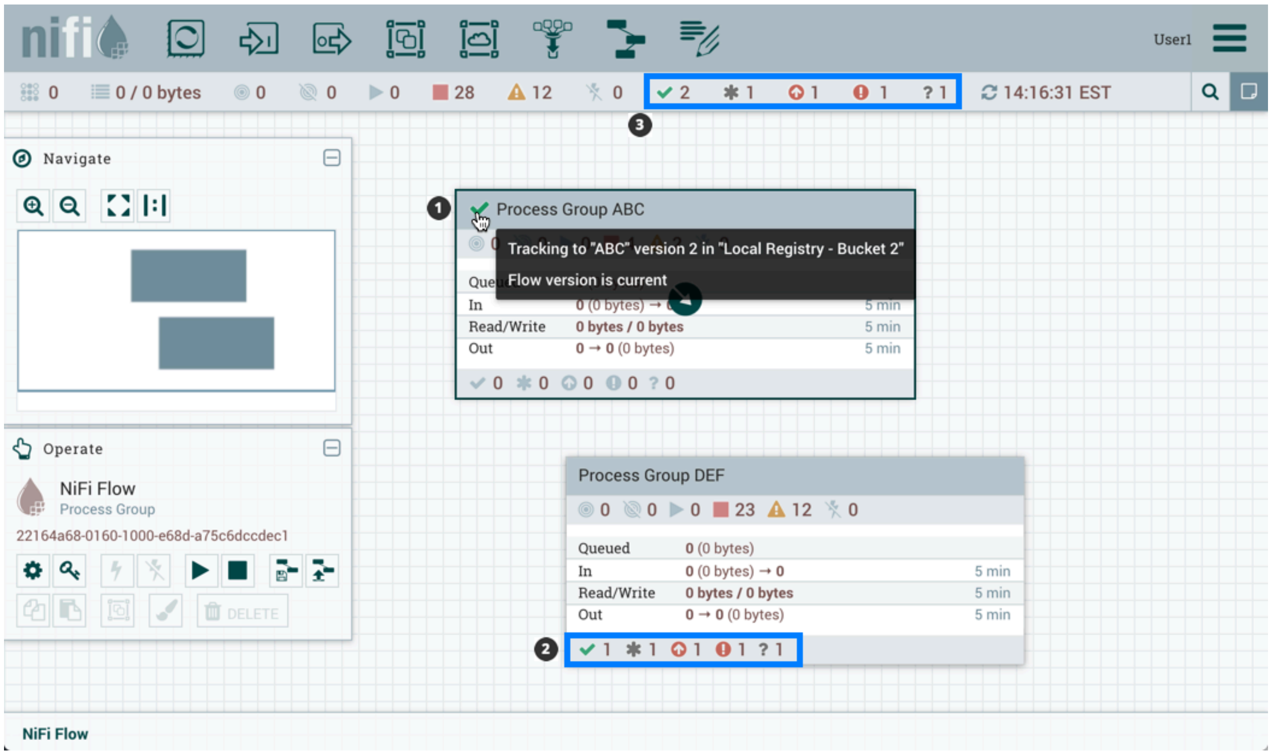
Versioned process groups exist in the following states:

- ✓ Up to date: The flow version is the latest.
- ✱ Locally modified: Local changes have been made.
- ⬆ Stale: A newer version of the flow is available.
- ! Locally modified and stale: Local changes have been made and a newer version of the flow is available.
- ? Sync failure: Unable to synchronize the flow with the registry.

Version state information is displayed:

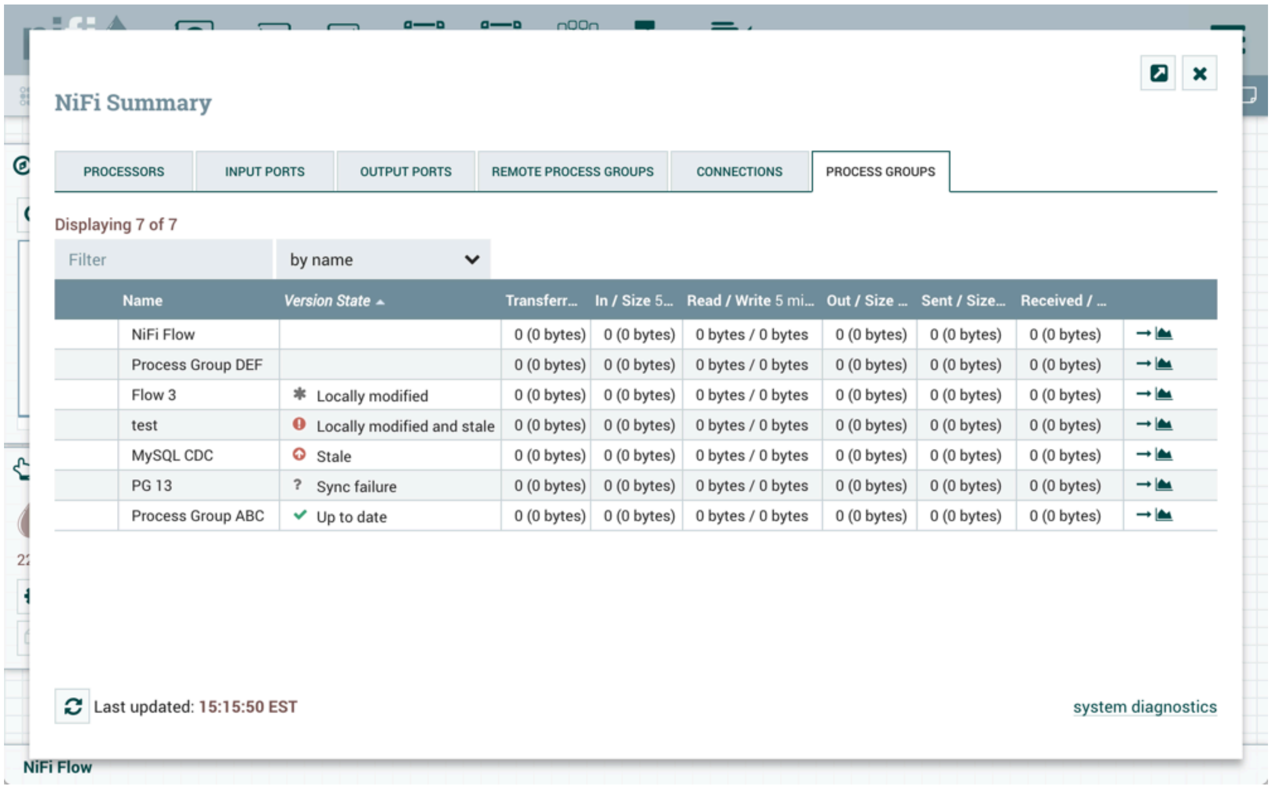
1. Next to the process group name, for the versioned process group itself. Hovering over the state icon displays additional information about the versioned flow.

2. At the bottom of a process group, for the versioned flows contained in the process group.
3. In the Status Bar at the top of the UI, for the versioned flows contained in the root process group.



Tracking to "ABC" version 2 in "Local Registry - Bucket 2"
Flow version is current

Version state information is also shown in the "Process Groups" tab of the Summary Page.

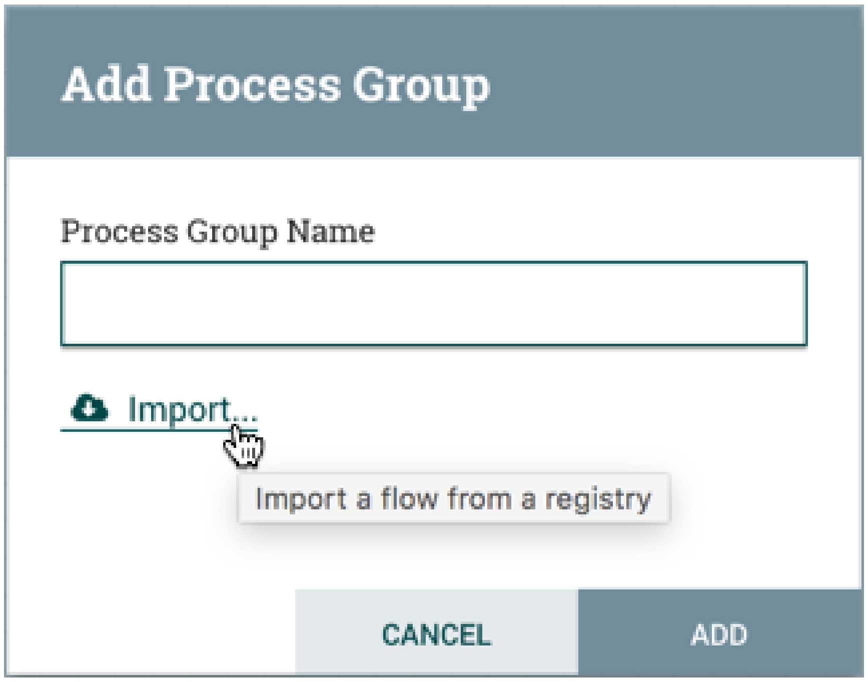


Name	Version State ▲	Transferr...	In / Size 5...	Read / Write 5 mi...	Out / Size ...	Sent / Size...	Received / ...
NiFi Flow		0 (0 bytes)	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 (0 bytes)	0 (0 bytes)
Process Group DEF		0 (0 bytes)	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 (0 bytes)	0 (0 bytes)
Flow 3	✱ Locally modified	0 (0 bytes)	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 (0 bytes)	0 (0 bytes)
test	Locally modified and stale	0 (0 bytes)	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 (0 bytes)	0 (0 bytes)
MySQL CDC	Stale	0 (0 bytes)	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 (0 bytes)	0 (0 bytes)
PG 13	? Sync failure	0 (0 bytes)	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 (0 bytes)	0 (0 bytes)
Process Group ABC	✓ Up to date	0 (0 bytes)	0 (0 bytes)	0 bytes / 0 bytes	0 (0 bytes)	0 (0 bytes)	0 (0 bytes)

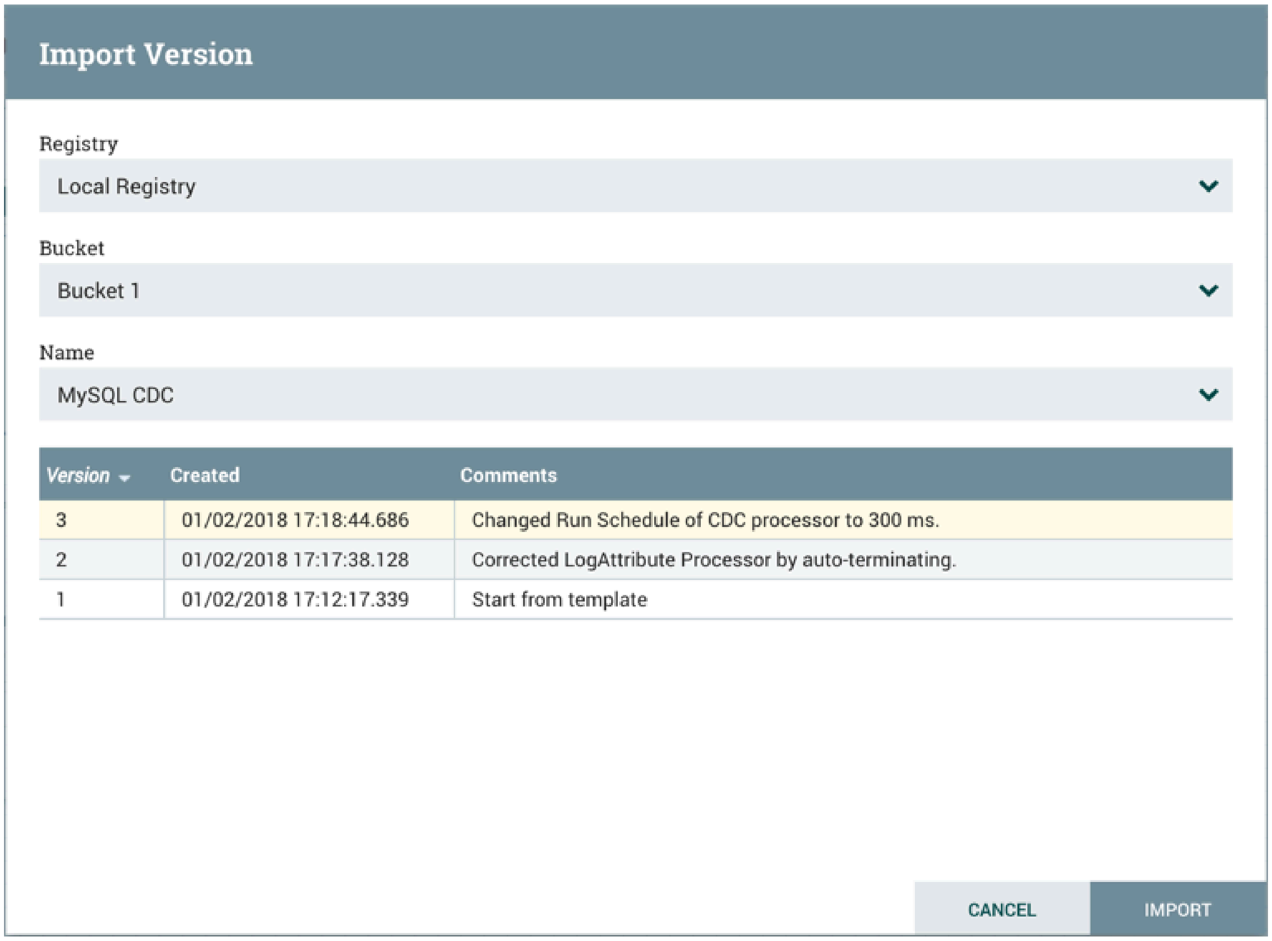
Note: To see the most recent version states, it may be necessary to right-click on the NiFi canvas and select 'Refresh' from the context menu.

Import a Versioned Flow

When a NiFi instance is connected to a registry, an "Import" link will appear in the Add Process Group dialog.



Selecting the link will open the Import Version dialog.



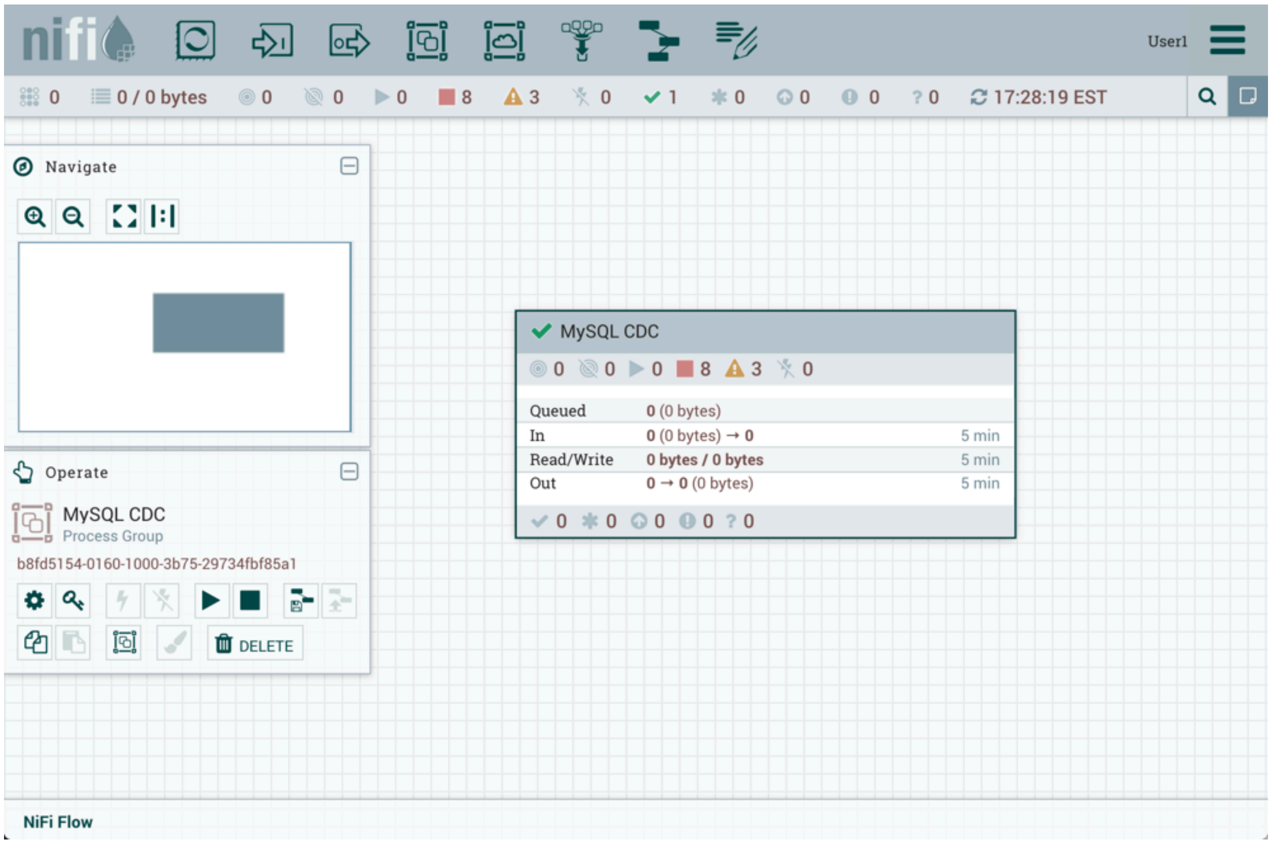
Registry: Local Registry

Bucket: Bucket 1

Name: MySQL CDC

Version	Created	Comments
3	01/02/2018 17:18:44.686	Changed Run Schedule of CDC processor to 300 ms.
2	01/02/2018 17:17:38.128	Corrected LogAttribute Processor by auto-terminating.
1	01/02/2018 17:12:17.339	Start from template

Connected registries will appear as options in the Registry drop-down menu. For the chosen Registry, buckets the user has access to will appear as options in the Bucket drop-down menu. The names of the flows in the chosen bucket will appear as options in the Name drop-down menu. Select the desired version of the flow to import and select "Import" for the dataflow to be placed on the canvas.


User1
0 0 / 0 bytes 0 0 0 8 3 0 1 0 0 0 0 17:28:19 EST
Navigate
Operate
MySQL CDC
Process Group
b8fd5154-0160-1000-3b75-29734fbf85a1
DELETE
NiFi Flow

MySQL CDC

0 0 0 8 3 0

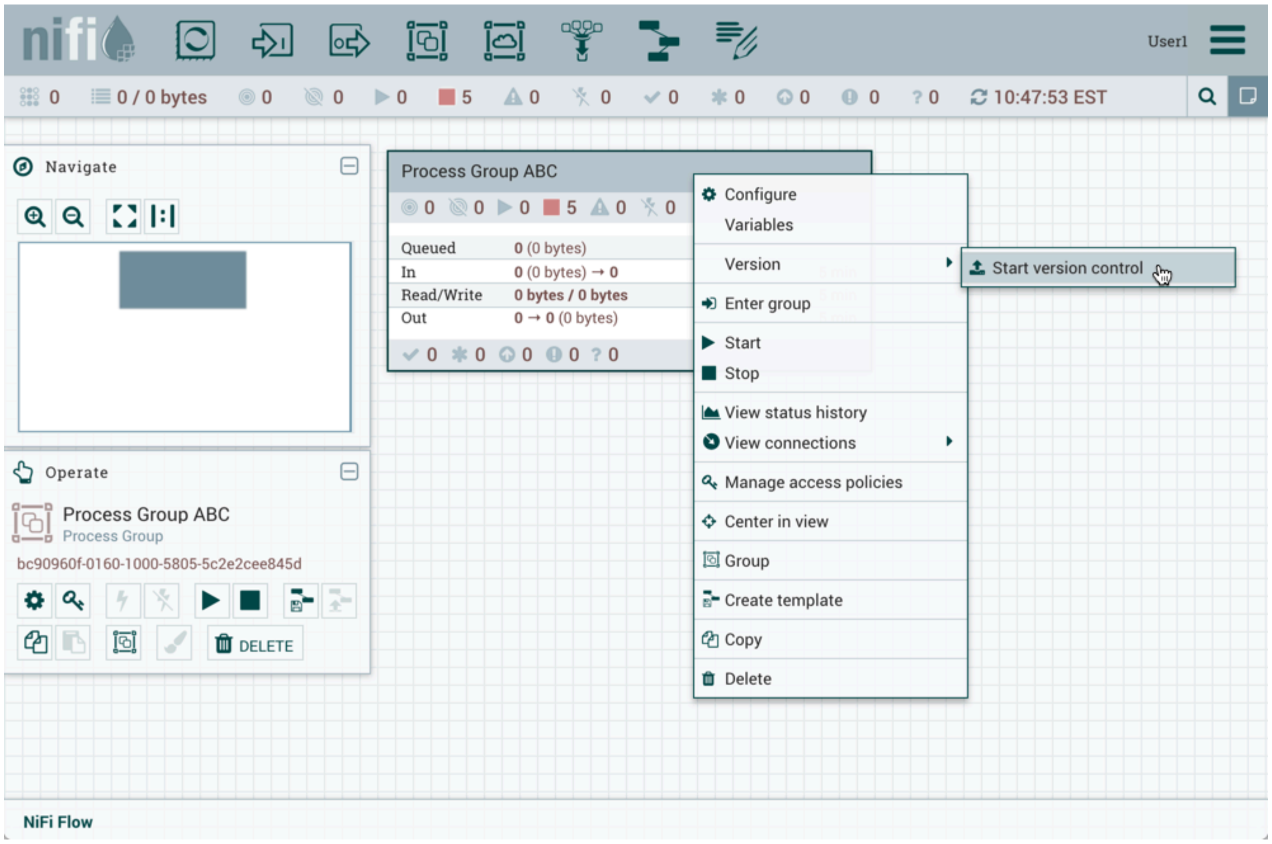
Queued	0 (0 bytes)	
In	0 (0 bytes) → 0	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 → 0 (0 bytes)	5 min

0 0 0 0 0

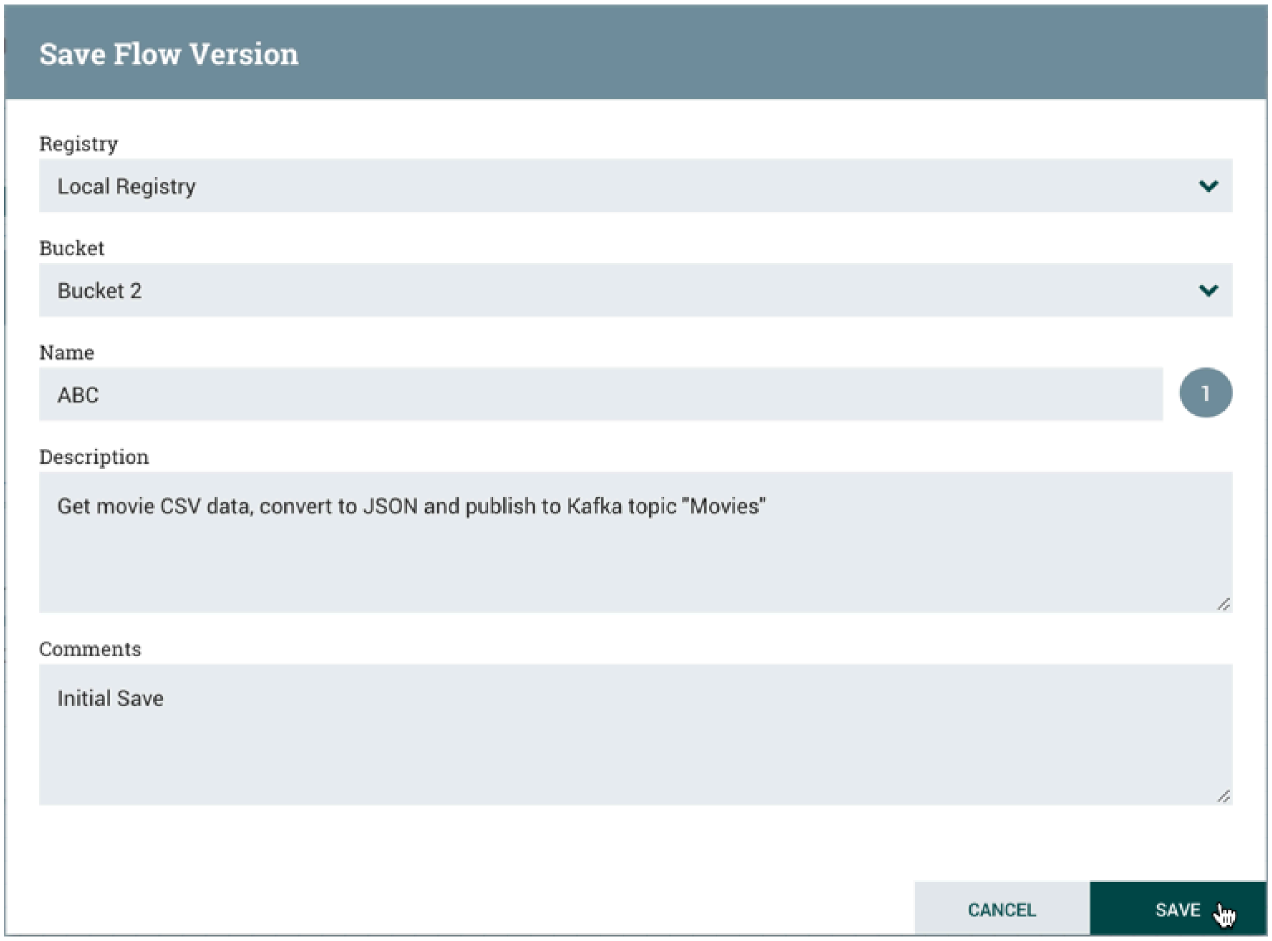
Since the version imported in this example is the latest version (MySQL CDC, Version 3), the state of the versioned process group is "Up to date" (✓). If the version imported had been an older version, the state would be "Stale" (⬆).

Start Version Control

To place a process group under version control, right-click on the process group and in the context menu, select "Version#Start version control".



In the Save Flow Version window, select a Registry and Bucket and enter a Name for the Flow. If desired, add content for the Description and Comment fields.


Save Flow Version

Registry: Local Registry

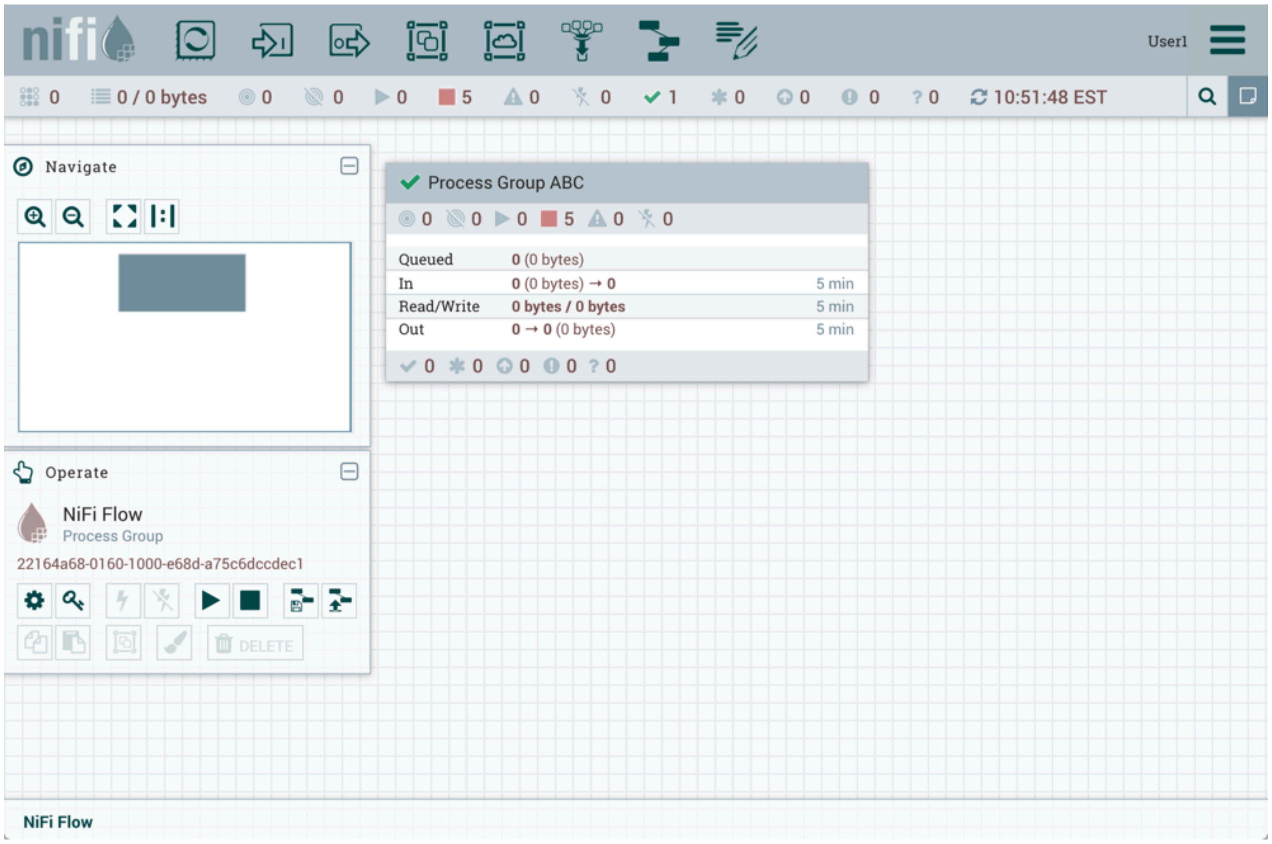
Bucket: Bucket 2

Name: ABC

Description: Get movie CSV data, convert to JSON and publish to Kafka topic "Movies"

Comments: Initial Save

Select Save and Version 1 of the flow is saved.



Process Group ABC

0 0 0 5 0 0

Queued	0 (0 bytes)	
In	0 (0 bytes) → 0	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 → 0 (0 bytes)	5 min

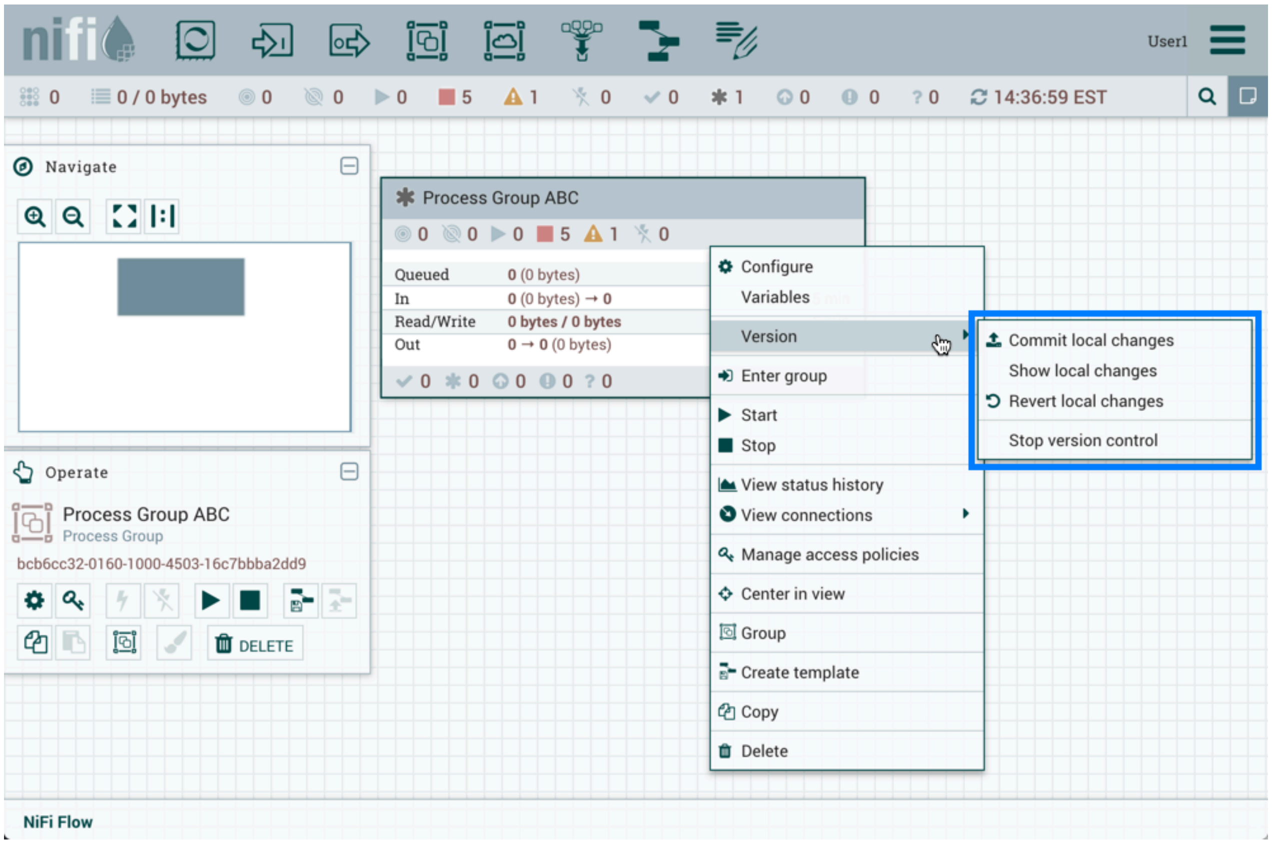
0 0 0 0 0

As the first and latest version of the flow, the state of the versioned process group is "Up to date" (✓).

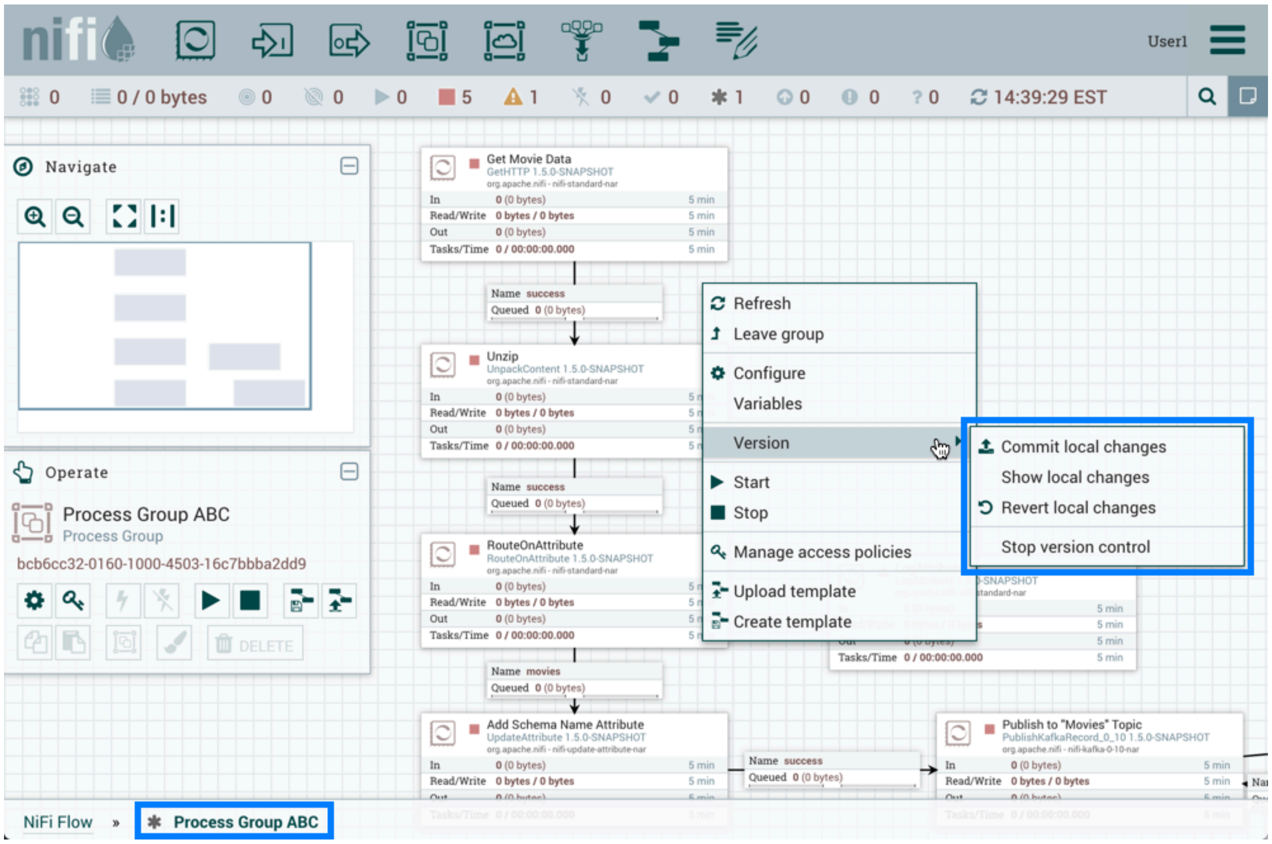
Note: The root process group can not be placed under version control.

Managing Local Changes

When changes are made to a versioned process group, the state of the component updates to "Locally modified" (✱). The DFM can show, revert or commit the local changes. These options are available for selection in the context menu when right-clicking on the process group:



or when right-clicking on the canvas inside the process group:



The following actions are not considered local changes:

- disabling/enabling processors and controller services
- stopping/starting processors
- modifying sensitive property values
- modifying remote process group URLs
- updating a processor that was referencing a non-existent controller service to reference an externally available controller service
- assigning, creating, modifying or deleting parameter contexts
- creating, modifying or deleting variables

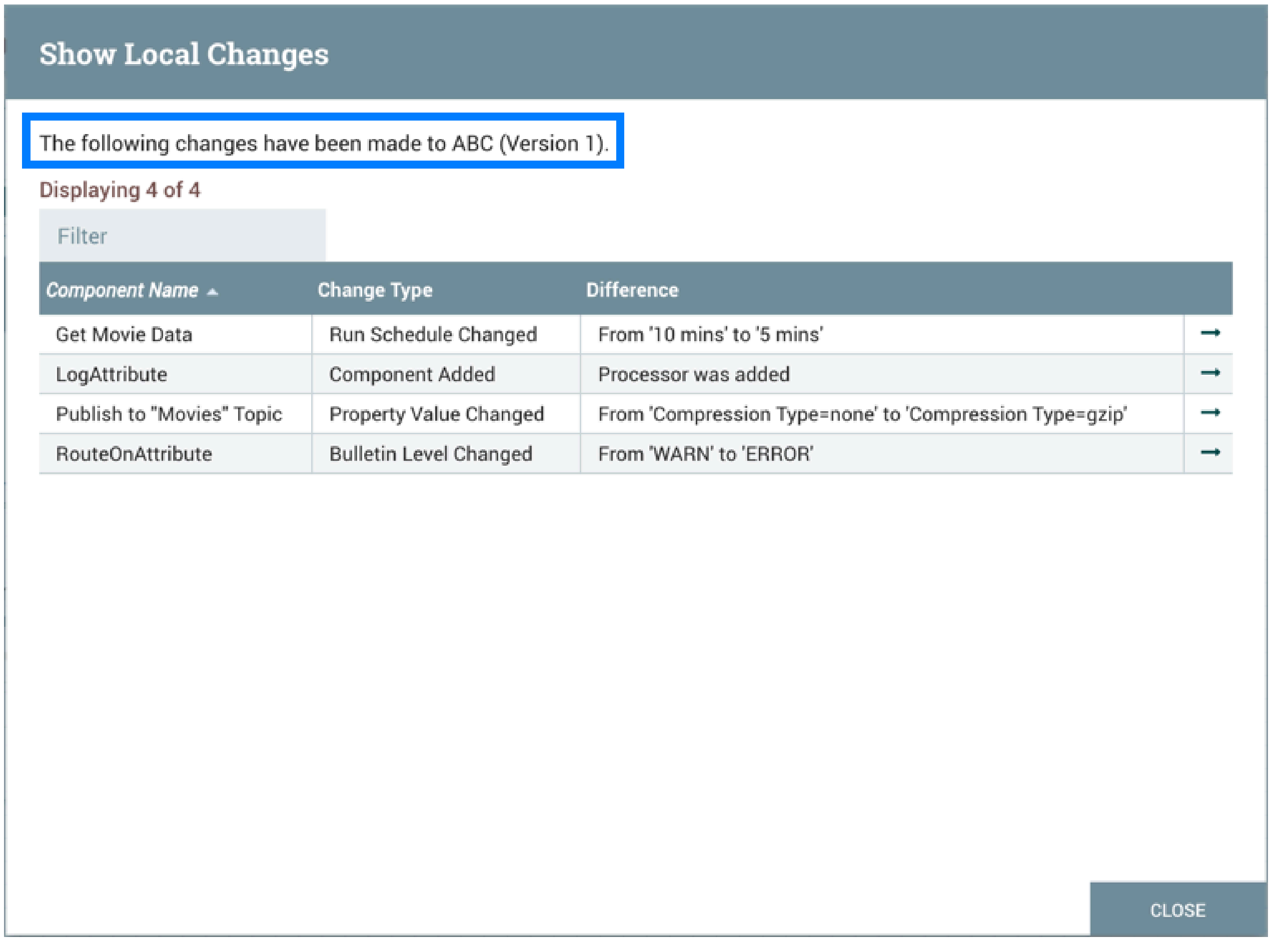
Note: Assigning or creating a parameter context does not trigger a local change because assigning or creating a parameter context on its own has not changed anything about what the flow processes. A component will have to be created or modified that uses a parameter in the parameter context, which will trigger a local change. Modifying a parameter context does not trigger a local change because parameters are intended to be different in each environment. When a versioned flow is imported, it is assumed there is a one-time operation required to set those parameters specific for the given environment. Deleting a parameter context does not trigger a local change because any components that reference parameters in that parameter context will need need to be modified, which will trigger a local change.

Note: Creating a variable does not trigger a local change because creating a variable on its own has not changed anything about what the flow processes. A component will have to be created or modified that uses the new variable, which will trigger a local change. Modifying a variable does not trigger a local change because variable values are intended to be different in each environment. When a versioned flow is imported, it is assumed there is a one-time operation required to set those variables specific for the given environment. Deleting a variable does not trigger a local change because the component that references that variable will need need to be modified, which will trigger a local change.

Note: Variables do not support sensitive values and will be included when versioning a Process Group. Variables are still supported for compatibility purposes but do not have the same power as Parameters such as support for sensitive properties and more granular control over who can create, modify or use them. Variables will be removed in a future release. As a result, it is highly recommended to switch to Parameters.

Show Local Changes

The local changes made to a versioned process group can be viewed in the Show Local Changes dialog by selecting "Version#Show local changes" from the context menu.


Show Local Changes

The following changes have been made to ABC (Version 1).

Displaying 4 of 4

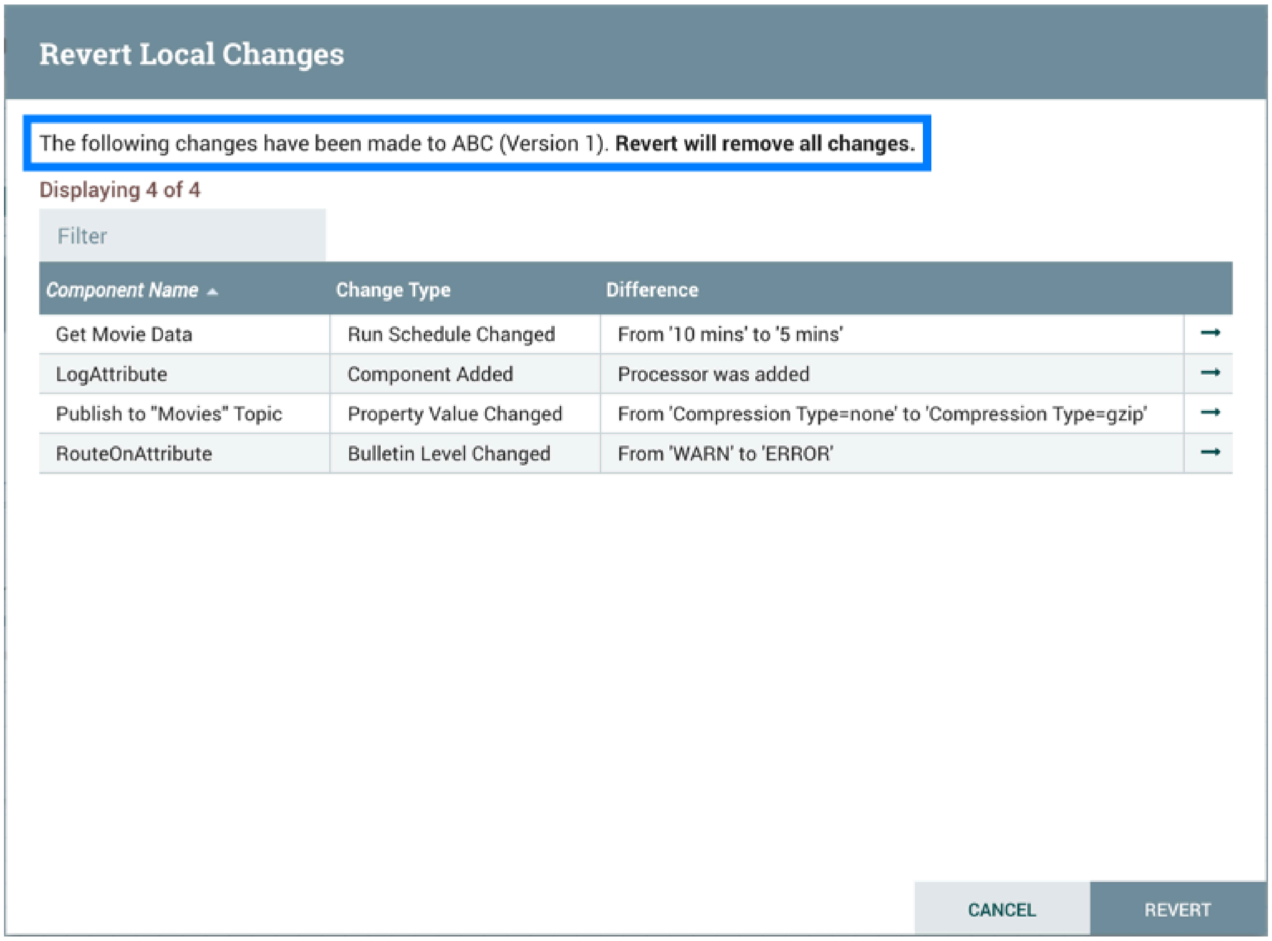
Component Name	Change Type	Difference	
Get Movie Data	Run Schedule Changed	From '10 mins' to '5 mins'	➞
LogAttribute	Component Added	Processor was added	➞
Publish to "Movies" Topic	Property Value Changed	From 'Compression Type=none' to 'Compression Type=gzip'	➞
RouteOnAttribute	Bulletin Level Changed	From 'WARN' to 'ERROR'	➞

You can navigate to a component by selecting the "Go To" icon (➞) in its row.

Note: As described in the Managing Local Changes section, there are exceptions to which actions are reviewable local changes. Additionally, multiple changes to the same property will only appear as one change in the list as the changes are determined by diffing the current state of the process group and the saved version of the process group noted in the Show Local Changes dialog.

Revert Local Changes

Revert the local changes made to a versioned process group by selecting "Version#Revert local changes" from the context menu. The Revert Local Changes dialog displays a list of the local changes for the DFM to review and consider prior to initiating the revert. Select "Revert" to remove all changes.



The following changes have been made to ABC (Version 1). **Revert will remove all changes.**

Displaying 4 of 4

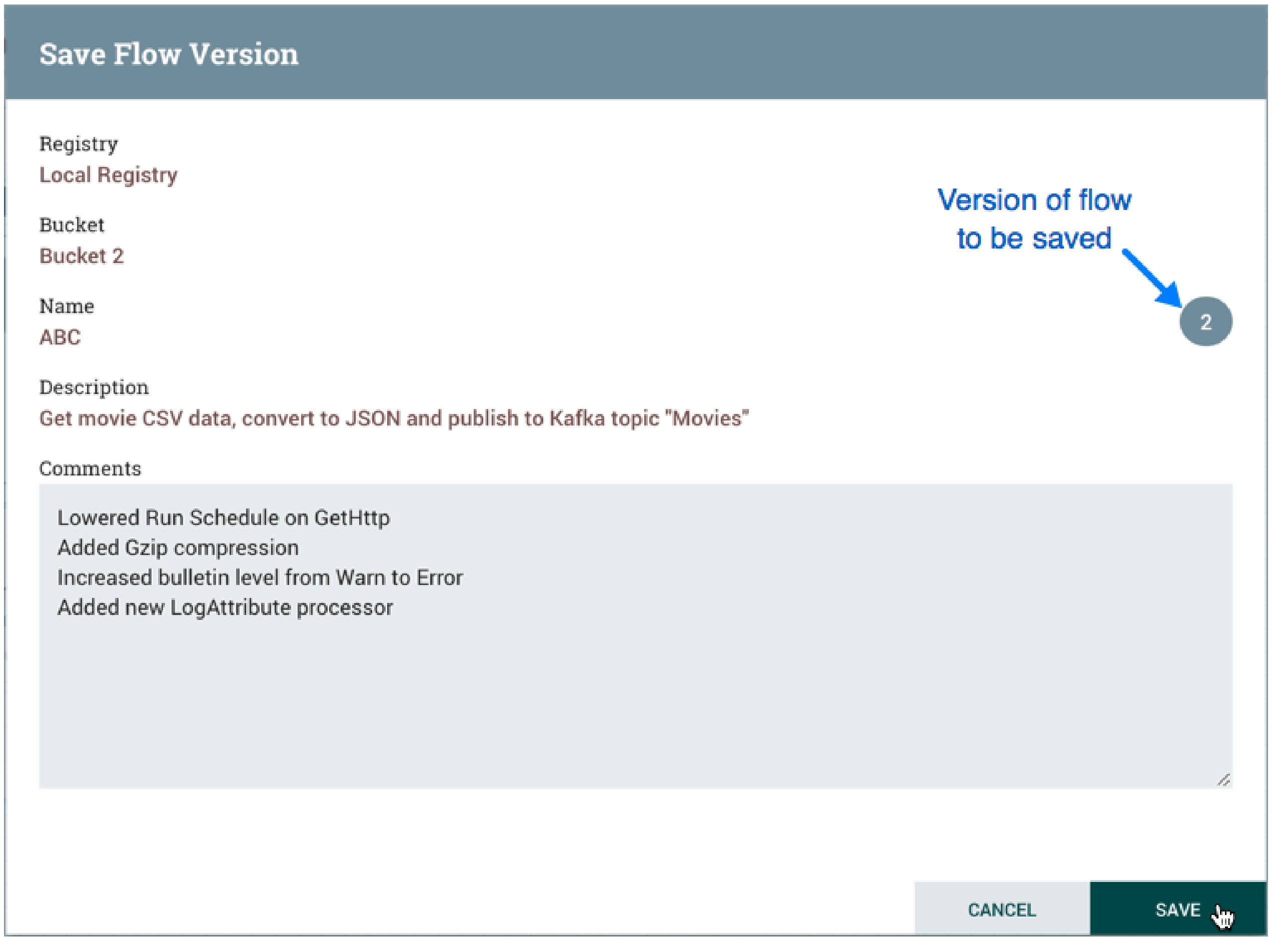
Component Name	Change Type	Difference	
Get Movie Data	Run Schedule Changed	From '10 mins' to '5 mins'	→
LogAttribute	Component Added	Processor was added	→
Publish to "Movies" Topic	Property Value Changed	From 'Compression Type=none' to 'Compression Type=gzip'	→
RouteOnAttribute	Bulletin Level Changed	From 'WARN' to 'ERROR'	→

You can navigate to a component by selecting the "Go To" icon (→) in its row.

Note: As described in the Managing Local Changes section, there are exceptions to which actions are revertible local changes. Additionally, multiple changes to the same property will only appear as one change in the list as the changes are determined by diffing the current state of the process group and the saved version of the process group noted in the Revert Local Changes dialog.

Commit Local Changes

To commit and save a flow version, select "Version#Commit local changes" from the context menu. In the Save Flow Version dialog, add comments if desired and select "Save".



Save Flow Version

Registry
Local Registry

Bucket
Bucket 2

Name
ABC

Description
Get movie CSV data, convert to JSON and publish to Kafka topic "Movies"

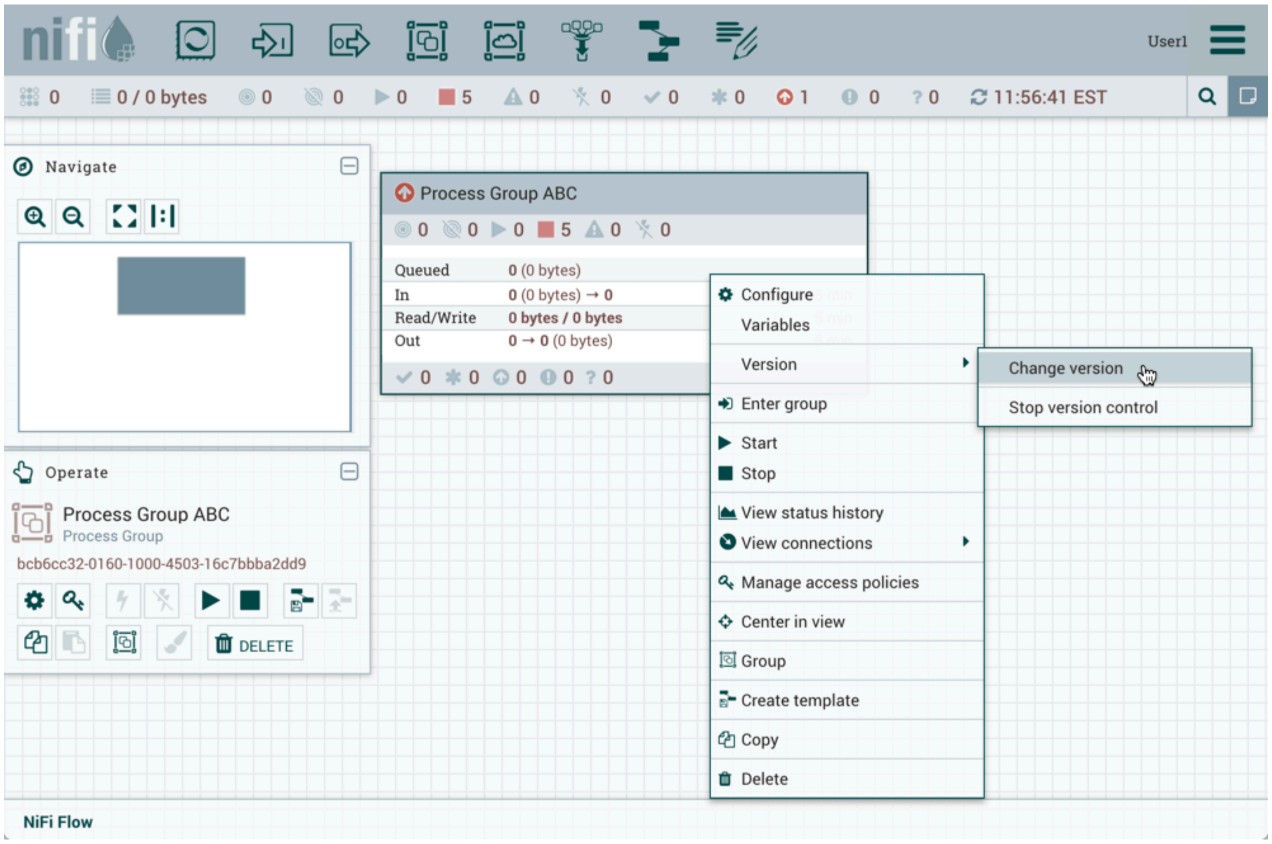
Comments

Lowered Run Schedule on GetHttp
Added Gzip compression
Increased bulletin level from Warn to Error
Added new LogAttribute processor

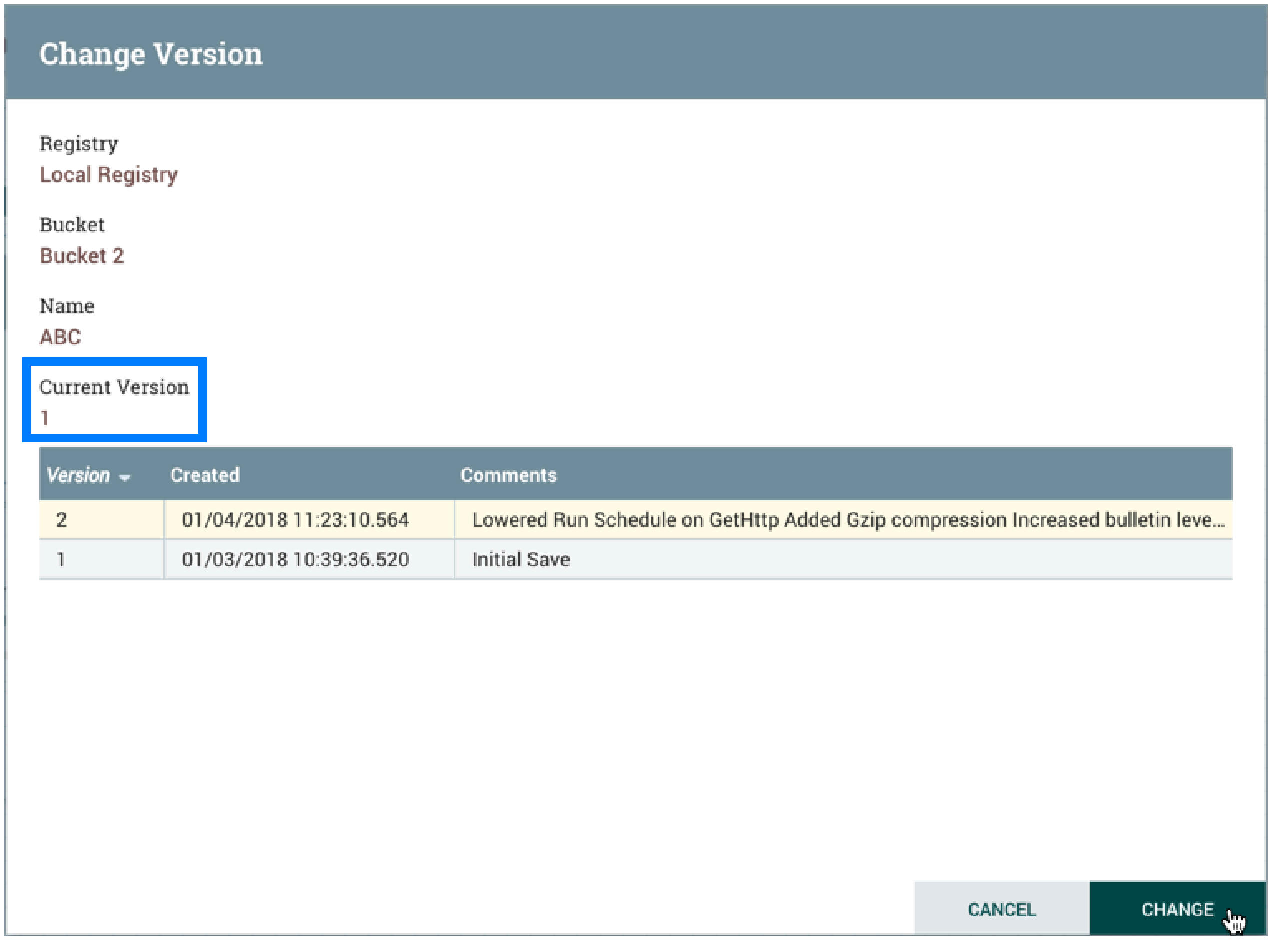
Local changes can not be committed if the version that has been modified is not the latest version. In this scenario, the version state is "Locally modified and stale" (❗).

Change Version

To change the version of a flow, right-click on the versioned process group and select "Version#Change version".



In the Change Version dialog, select the desired version and select "Change":



Change Version

Registry
Local Registry

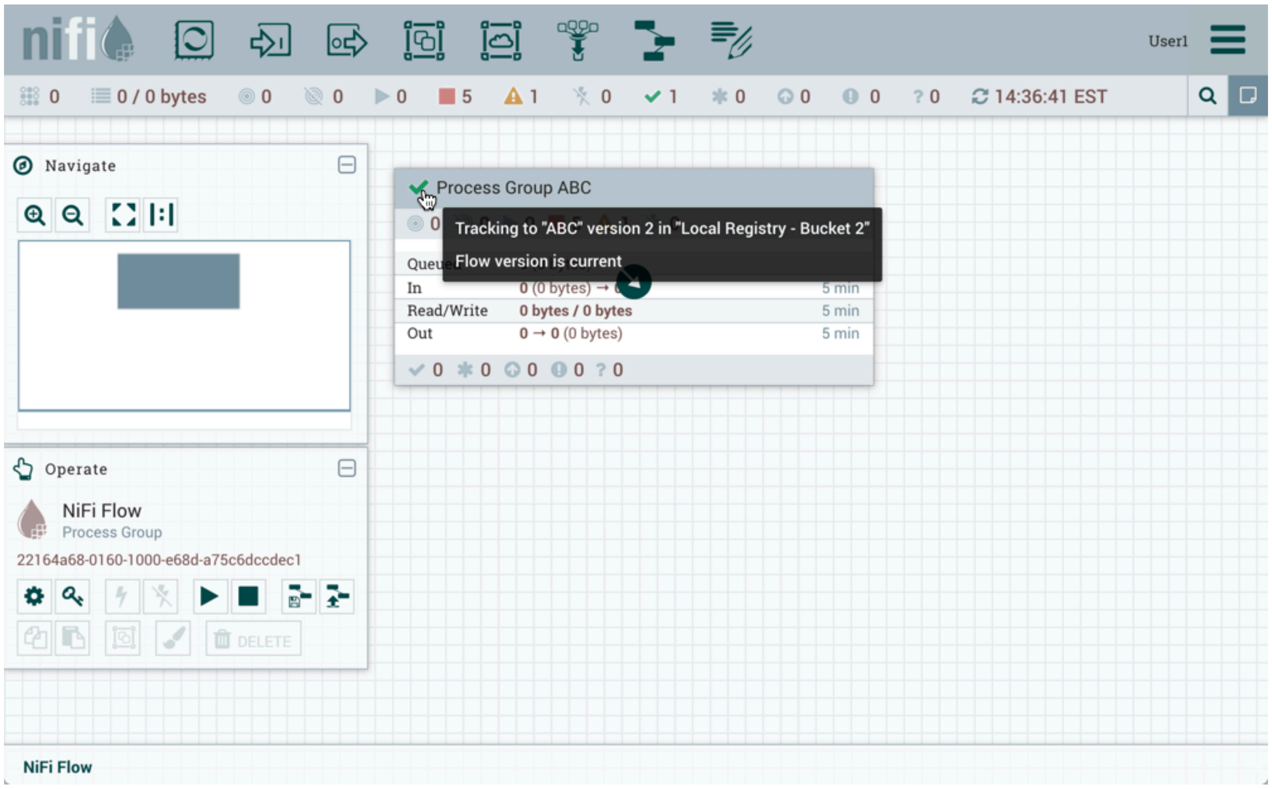
Bucket
Bucket 2

Name
ABC

Current Version
1

Version	Created	Comments
2	01/04/2018 11:23:10.564	Lowered Run Schedule on GetHttp Added Gzip compression Increased bulletin leve...
1	01/03/2018 10:39:36.520	Initial Save

The version of the flow is changed:



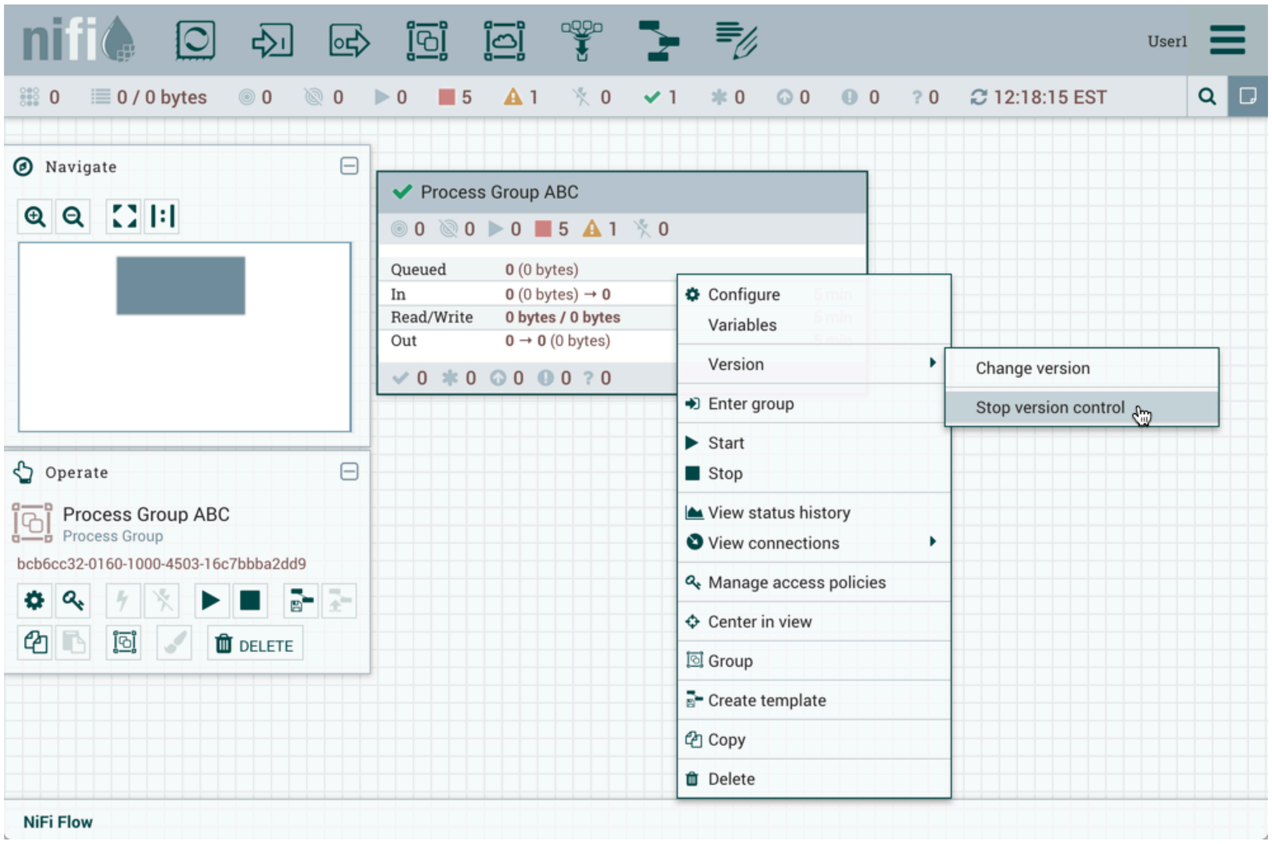
User1
0 0 / 0 bytes 0 0 0 5 1 0 1 0 0 0 0 14:36:41 EST
Navigate
Operate
NiFi Flow
Process Group
22164a68-0160-1000-e68d-a75c6dccdec1
DELETE
Process Group ABC
Tracking to "ABC" version 2 in "Local Registry - Bucket 2"
Flow version is current
In 0 (0 bytes) → 5 min
Read/Write 0 bytes / 0 bytes 5 min
Out 0 → 0 (0 bytes) 5 min
NiFi Flow

In the example shown, the versioned flow is upgraded from an older to the newer latest version. However, a versioned flow can also be rollbacked to an older version.

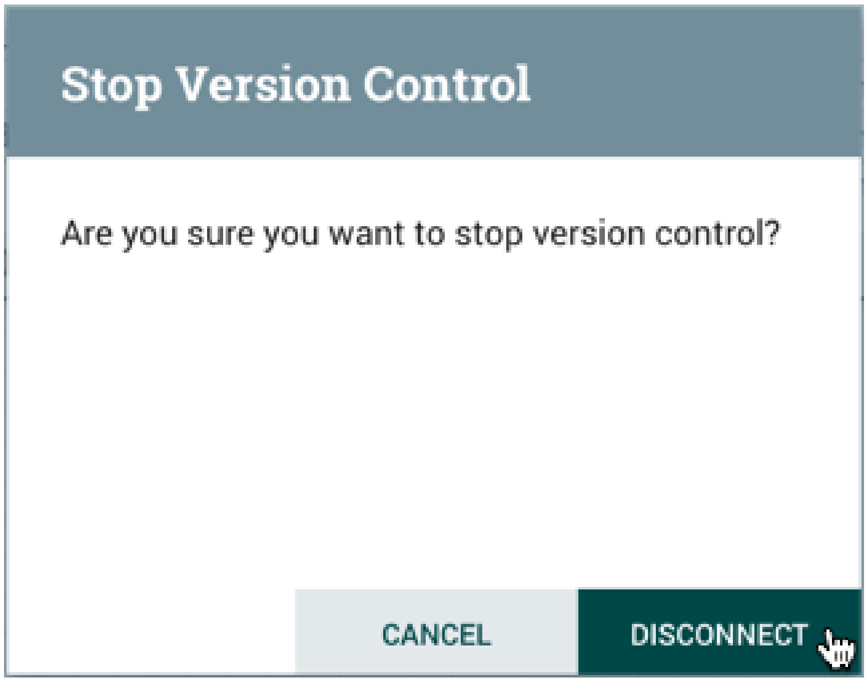
Note: For "Change version" to be an available selection, local changes to the process group need to be reverted.

Stop Version Control

To stop version control on a flow, right-click on the versioned process group and select "Version#Stop version control":

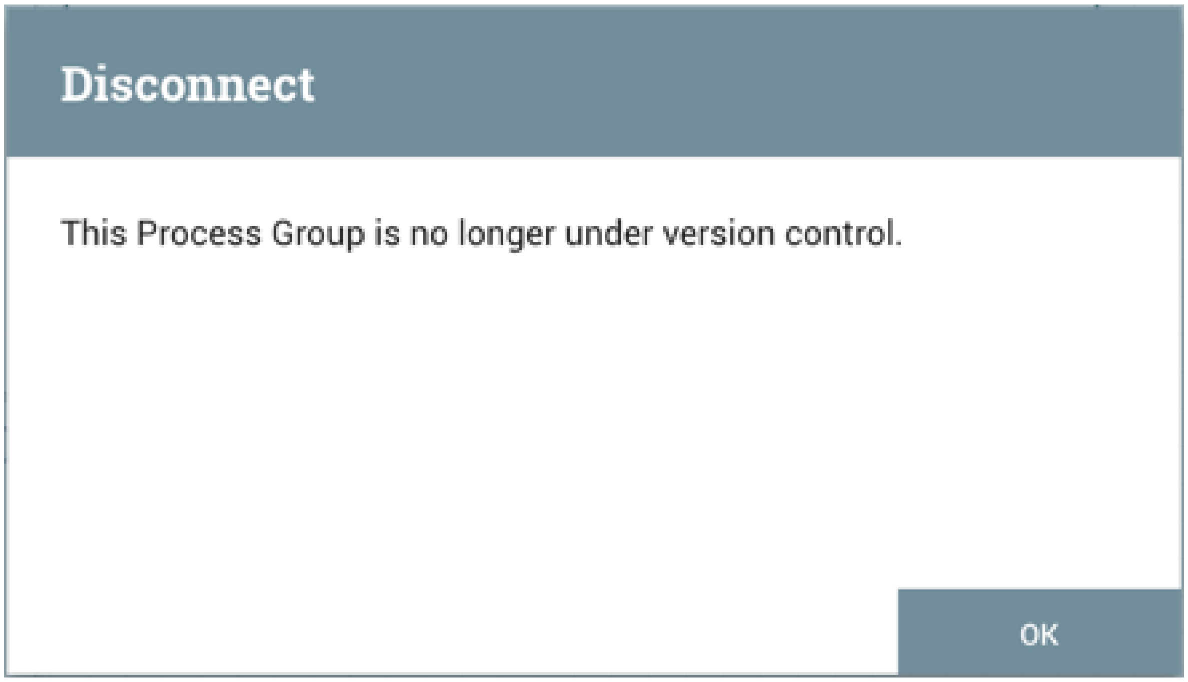


In the Stop Version Control dialog, select "Disconnect".

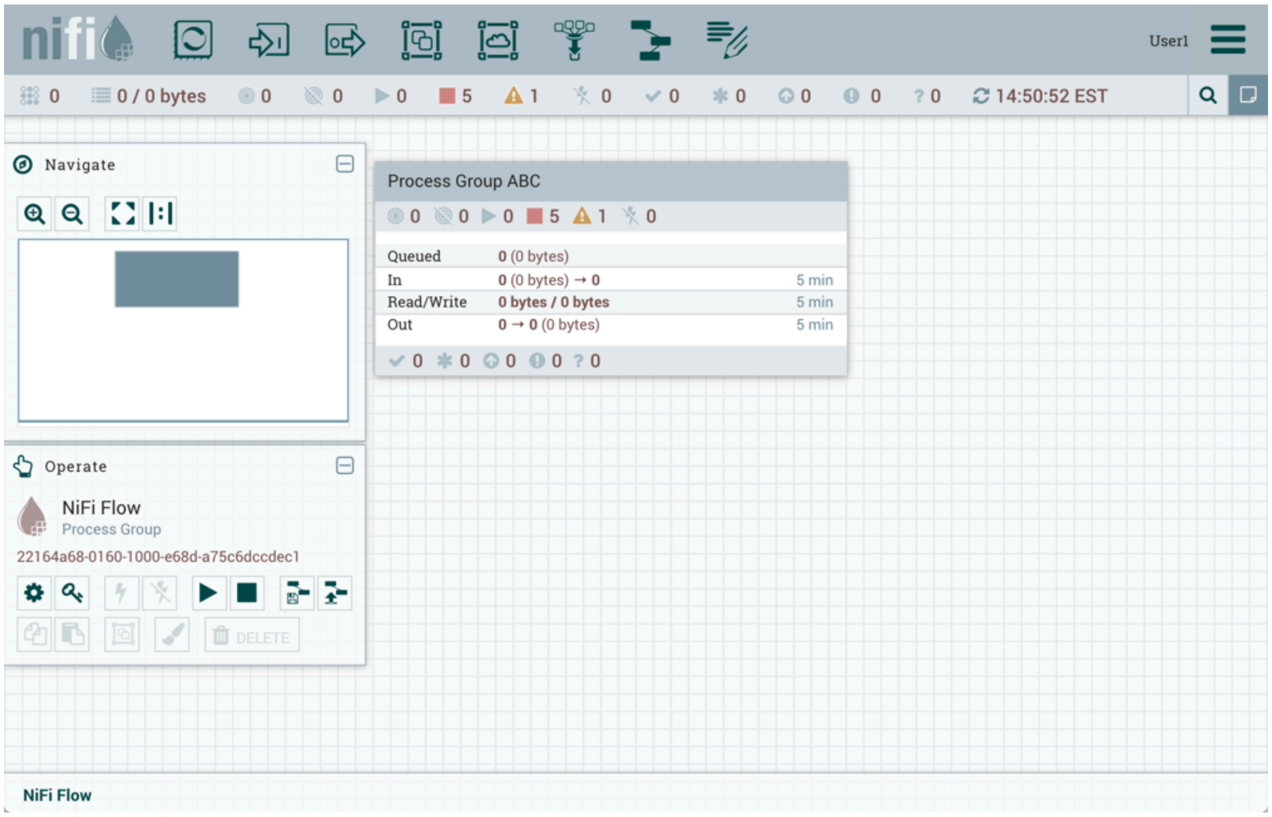

Stop Version Control

Are you sure you want to stop version control?

The removal of the process group from version control is confirmed.


Disconnect

This Process Group is no longer under version control.


User1
0 0 / 0 bytes 0 0 0 5 1 0 0 0 0 0 0 14:50:52 EST
Navigate
Operate
NiFi Flow
Process Group
22164a68-0160-1000-e68d-a75c6dccdec1
DELETE
NiFi Flow

Process Group ABC

0 0 0 5 1 0

Queued	0 (0 bytes)	
In	0 (0 bytes) → 0	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 → 0 (0 bytes)	5 min

0 0 0 0 0

Nested Versioned Flows

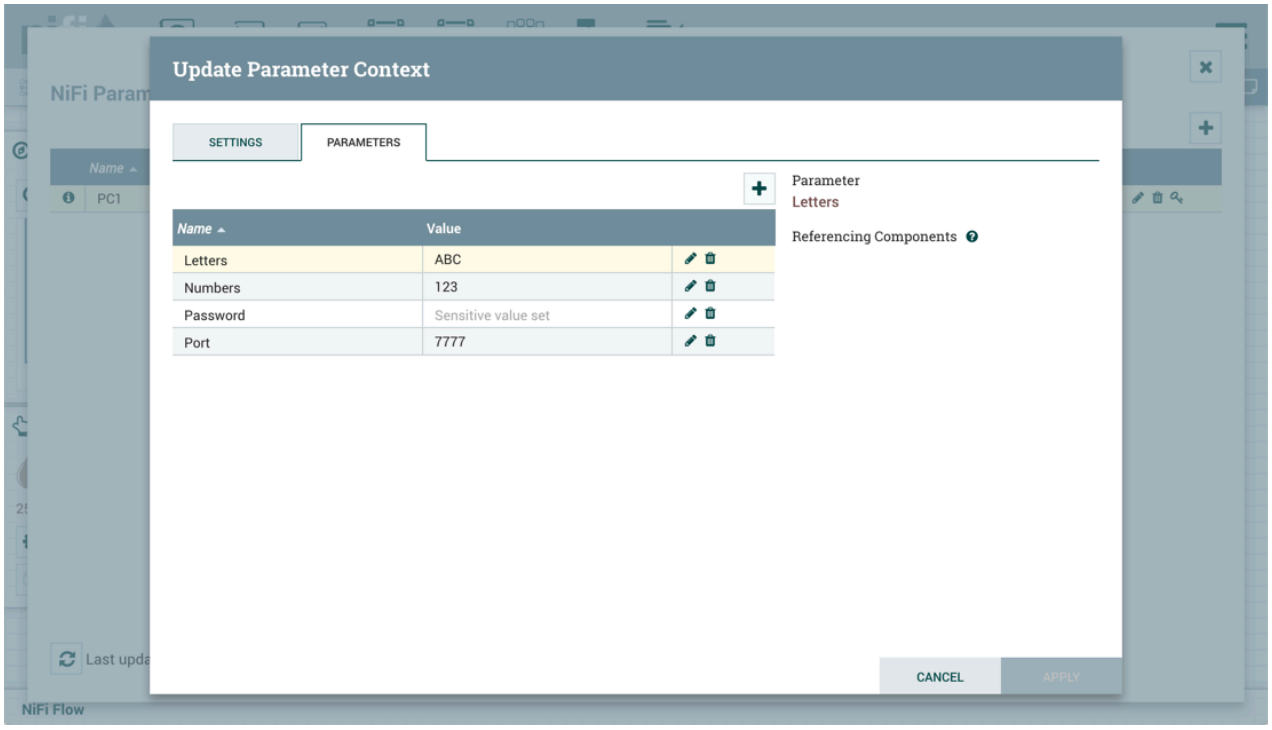
A versioned process group can contain other versioned process groups. However, local changes to a parent process group cannot be reverted or saved if it contains a child process group that also has local changes. The child process group must first be reverted or have its changes committed for those actions to be performed on the parent process group.

Parameters in Versioned Flows

When exporting a versioned flow to a Flow Registry, the name of the Parameter Context is sent for each process group that is stored. The Parameters (names, descriptions, values, whether or not sensitive) are also stored with the flow. However, Sensitive Parameter values are not stored.

When a versioned flow is imported, a Parameter Context will be created for each one that doesn't already exist in the NiFi instance. When importing a versioned flow from Flow Registry, if NiFi has a Parameter Context with the same name, the values are merged, as described in the following example:

A flow has a Parameter Context "PC1" with the following parameters:



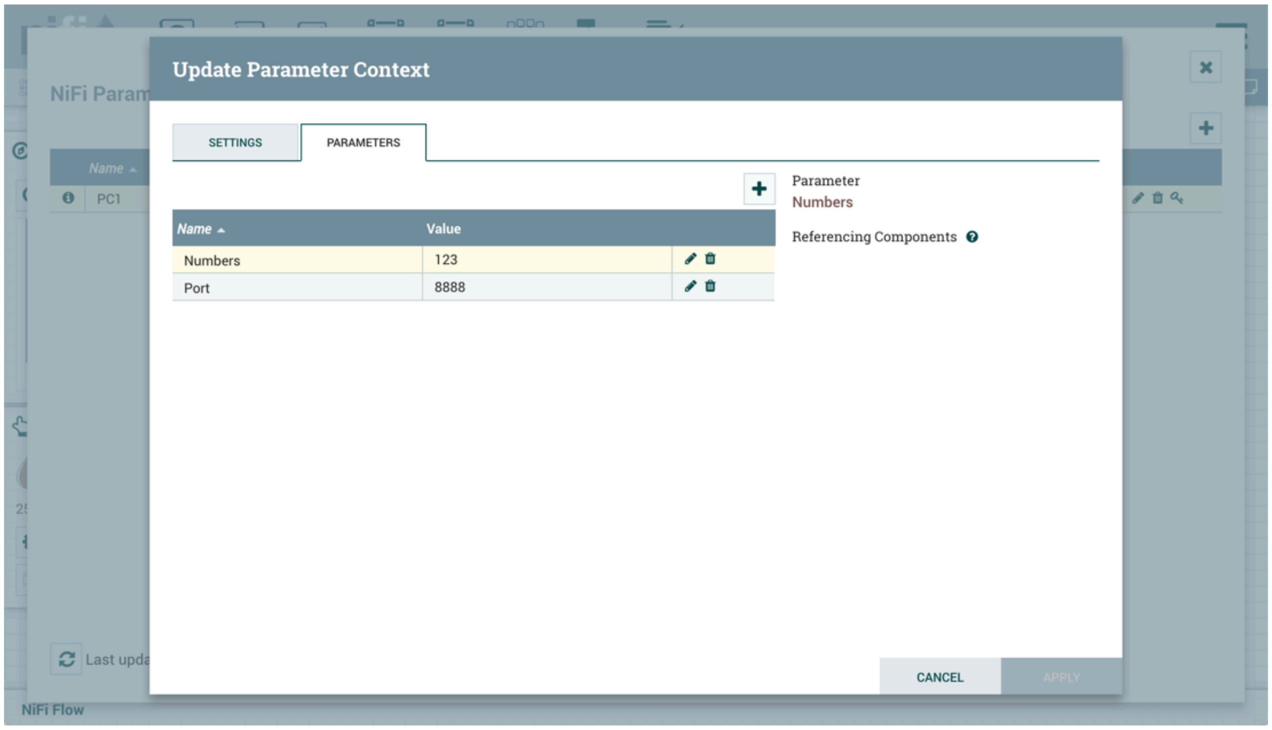
Name	Value
Letters	ABC
Numbers	123
Password	Sensitive value set
Port	7777

Parameter
Letters

Referencing Components

The flow is exported and saved to the Flow Registry.

A NiFi instance has a Parameter Context also named "PC1" with the following parameters:

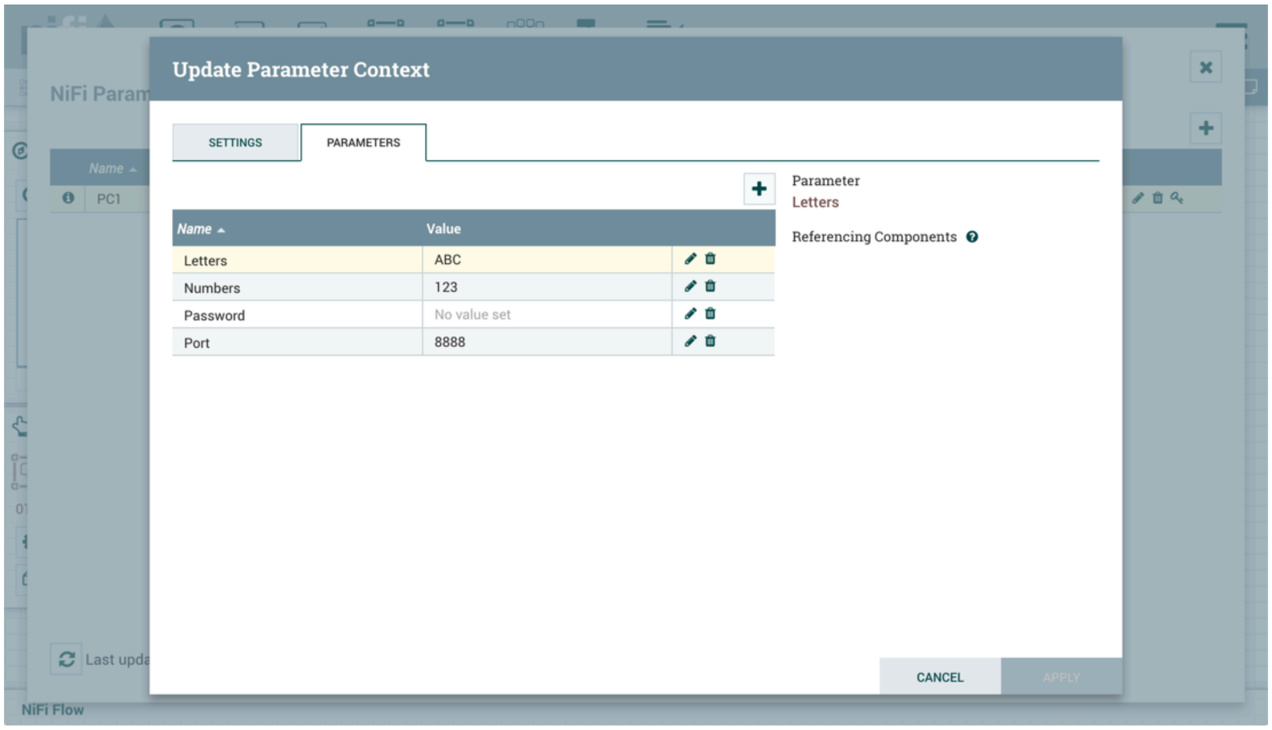


Name	Value
Numbers	123
Port	8888

Parameter
Numbers

Referencing Components

The versioned flow is imported into the NiFi instance. The Parameter Context "PC1" now has the following parameters:



Name	Value
Letters	ABC
Numbers	123
Password	No value set
Port	8888

Parameter
Letters

Referencing Components

The "Letters" parameter did not exist in the NiFi instance and was added. The "Numbers" parameter existed in both the versioned flow and NiFi instance with identical values, so no changes were made. "Password" is a sensitive Parameter missing from the NiFi instance, so it was added but with no value. "Port" existed in the NiFi instance with a different value than the versioned flow, so its value remained unchanged.

Parameter Contexts are handled similarly when a flow version is changed. Consider the following two examples:

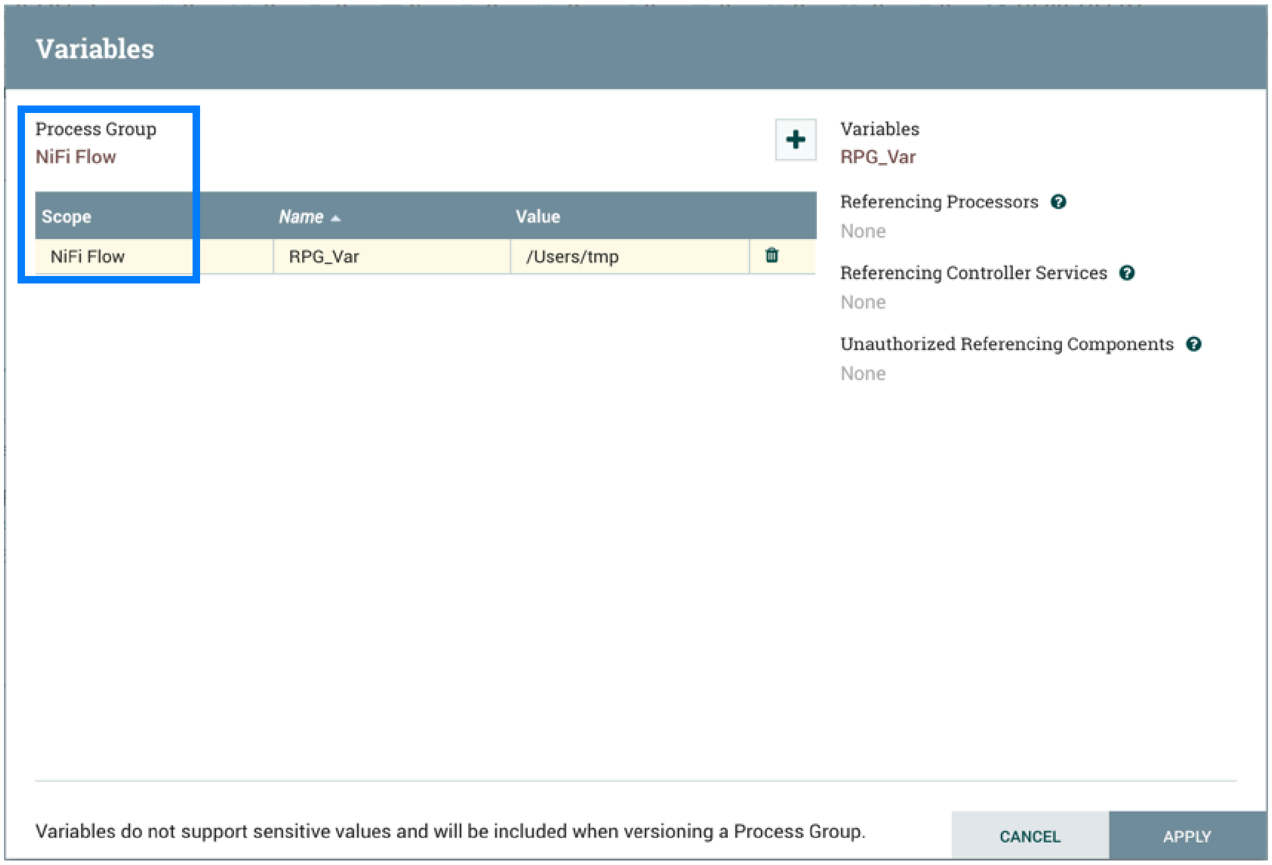
If the versioned flow referenced earlier is changed to another version (Version 2) and Version 2's Parameter Context "PC1" has a "Colors" Parameter, "Colors" will be added to "PC1" in the NiFi instance.

Version 1 of a flow does not have a Parameter Context associated with it. A new version (Version 2) does. When the flow is changed from Version 1 to Version 2, one of the following occurs:

- A new Parameter Context is created if it does not already exist
- An existing Parameter Context is assigned (by name) to the Process Group and the values of the Parameter Contexts are merged

Variables in Versioned Flows

Variables are included when a process group is placed under version control. If a versioned flow is imported that references a variable not defined in the versioned process group, the reference is maintained if the variable exists. If the referenced variable does not exist, a copy of the variable will be defined in the process group. To illustrate, assume the variable "RPG_Var" is defined in the root process group:



Variables

Process Group
NiFi Flow

Scope	Name	Value	
NiFi Flow	RPG_Var	/Users/tmp	

Variables
RPG_Var

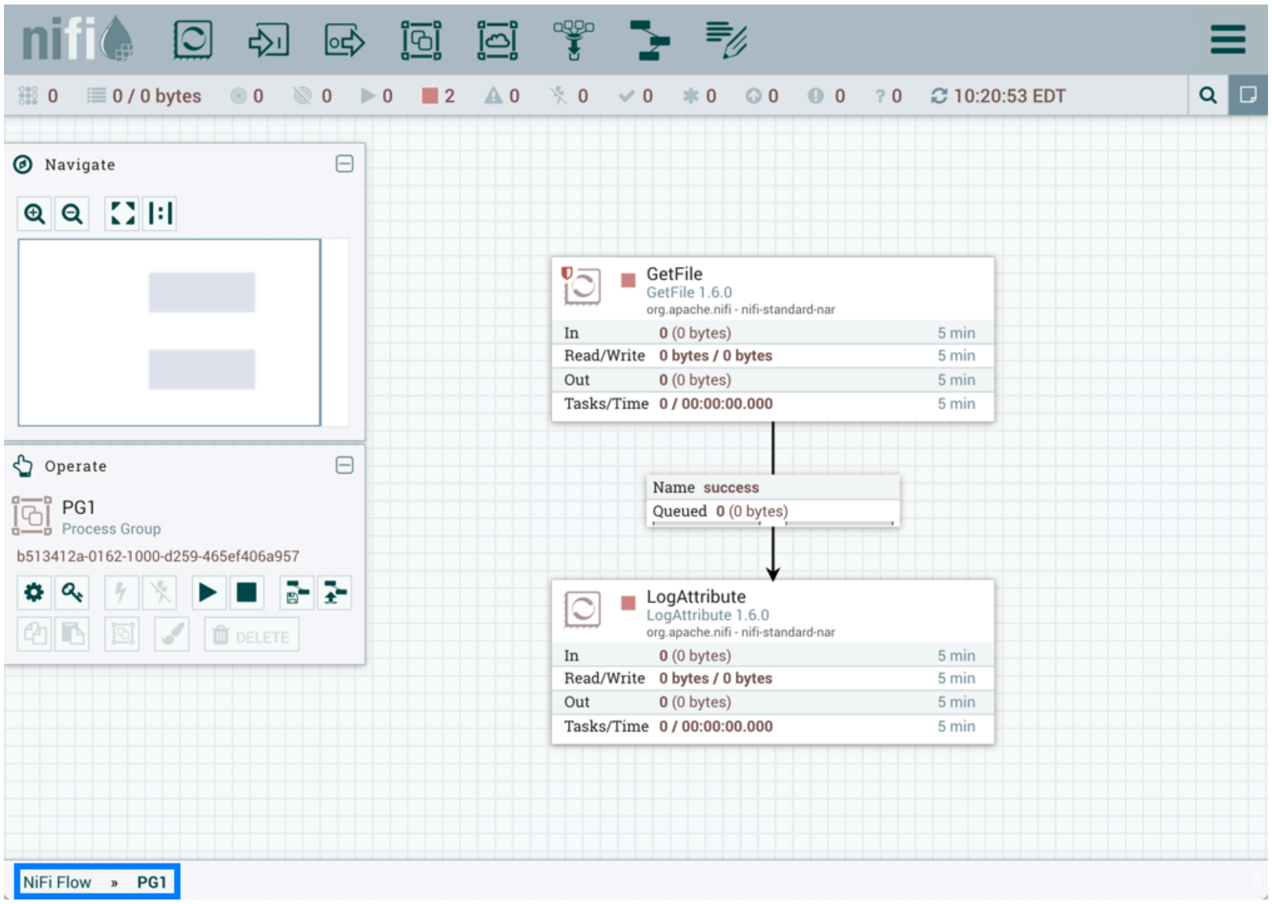
Referencing Processors
None

Referencing Controller Services
None

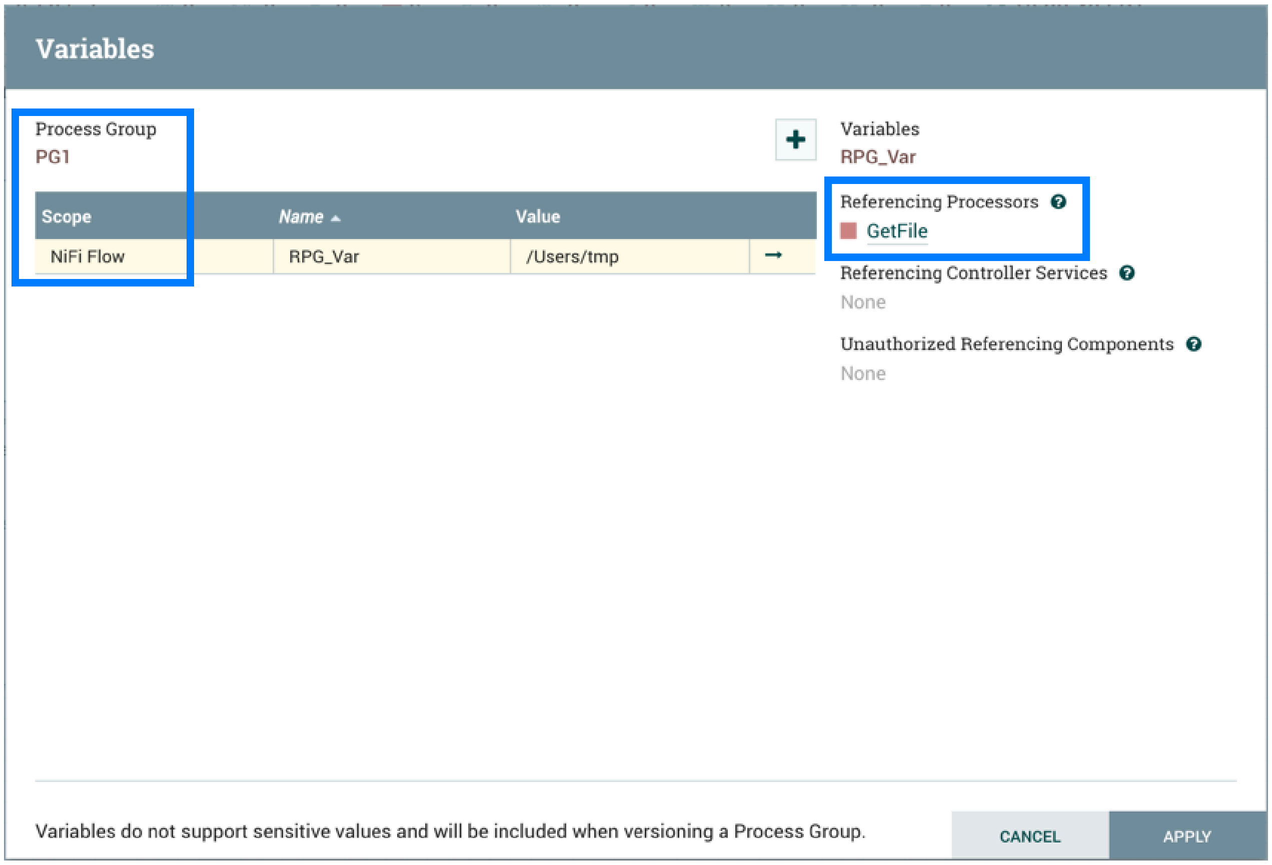
Unauthorized Referencing Components
None

Variables do not support sensitive values and will be included when versioning a Process Group.

A process group PG1 is created:



The GetFile processor in PG1 references the variable "RPG_Var":



Variables

Process Group
PG1

Scope	Name ▲	Value	
NiFi Flow	RPG_Var	/Users/tmp	→

Variables
RPG_Var

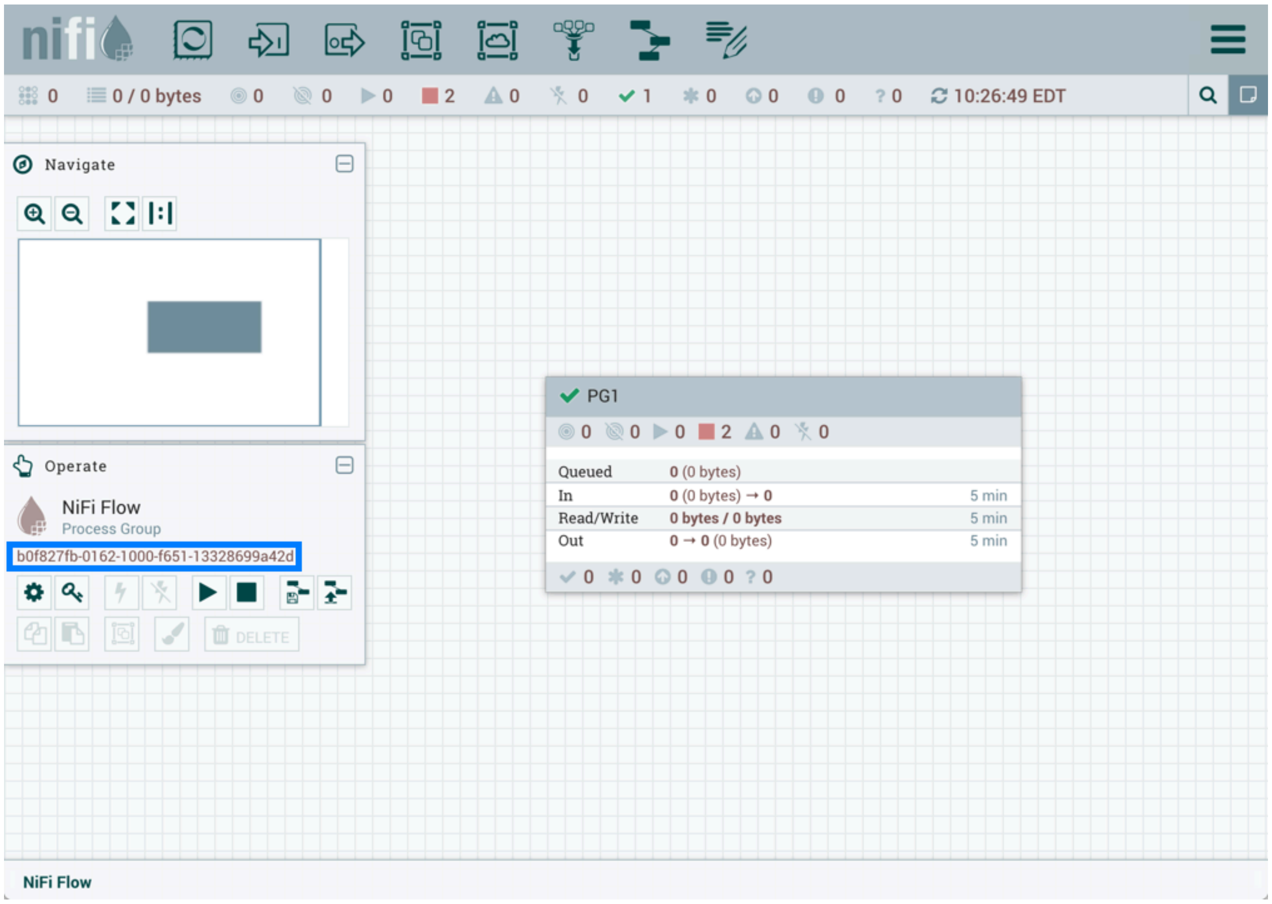
Referencing Processors
🟥 GetFile

Referencing Controller Services
None

Unauthorized Referencing Components
None

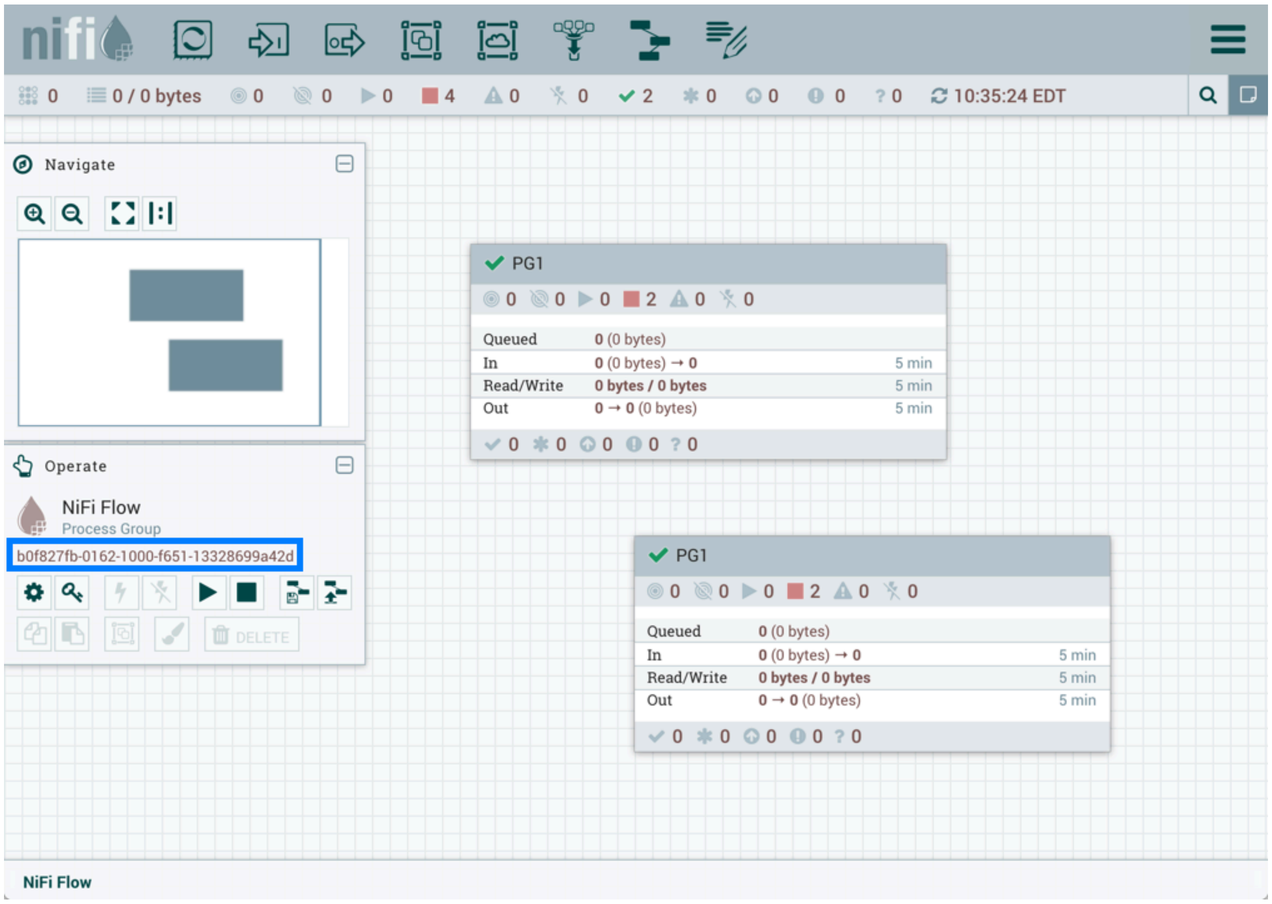
Variables do not support sensitive values and will be included when versioning a Process Group.

PG1 is saved as a versioned flow:

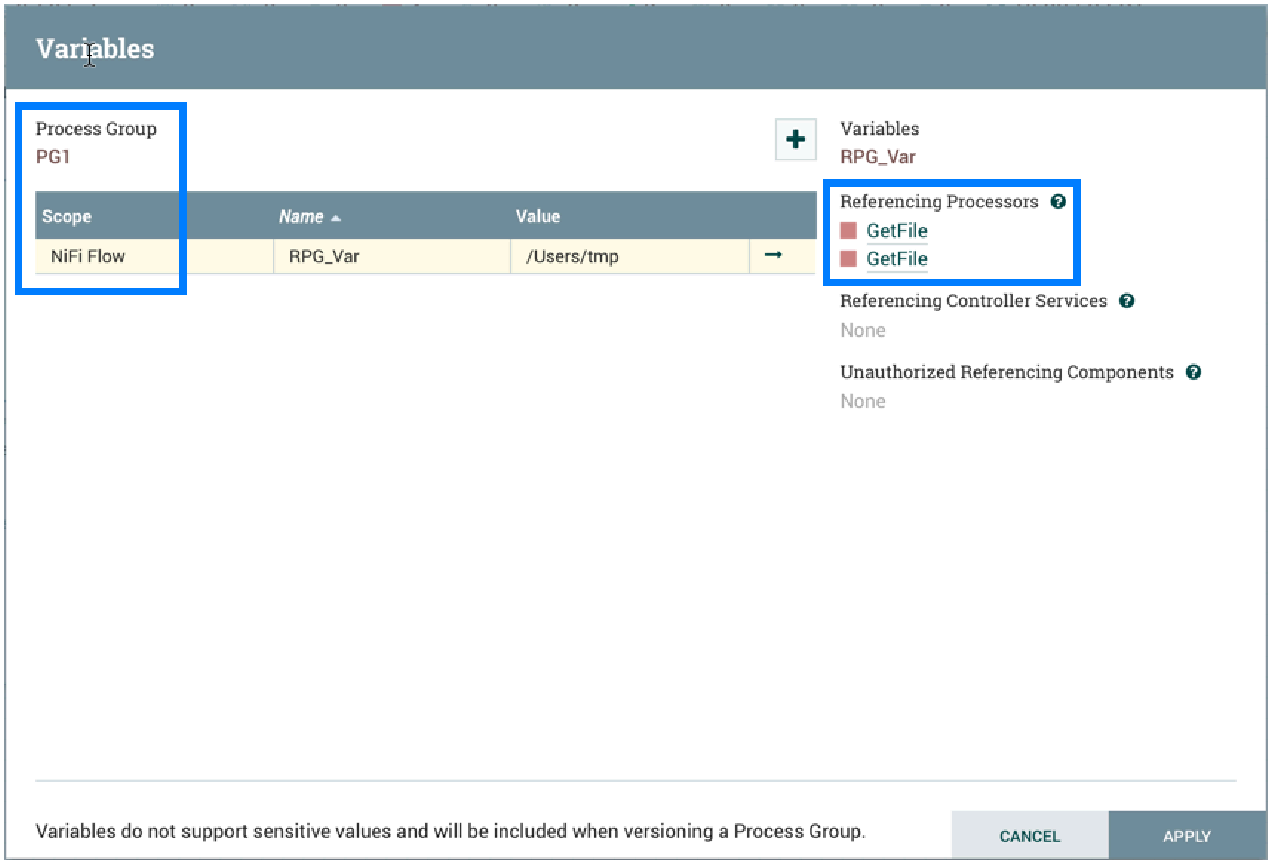


Queued	0 (0 bytes)	
In	0 (0 bytes) → 0	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 → 0 (0 bytes)	5 min

If PG1 versioned flow is imported into this same NiFi instance:



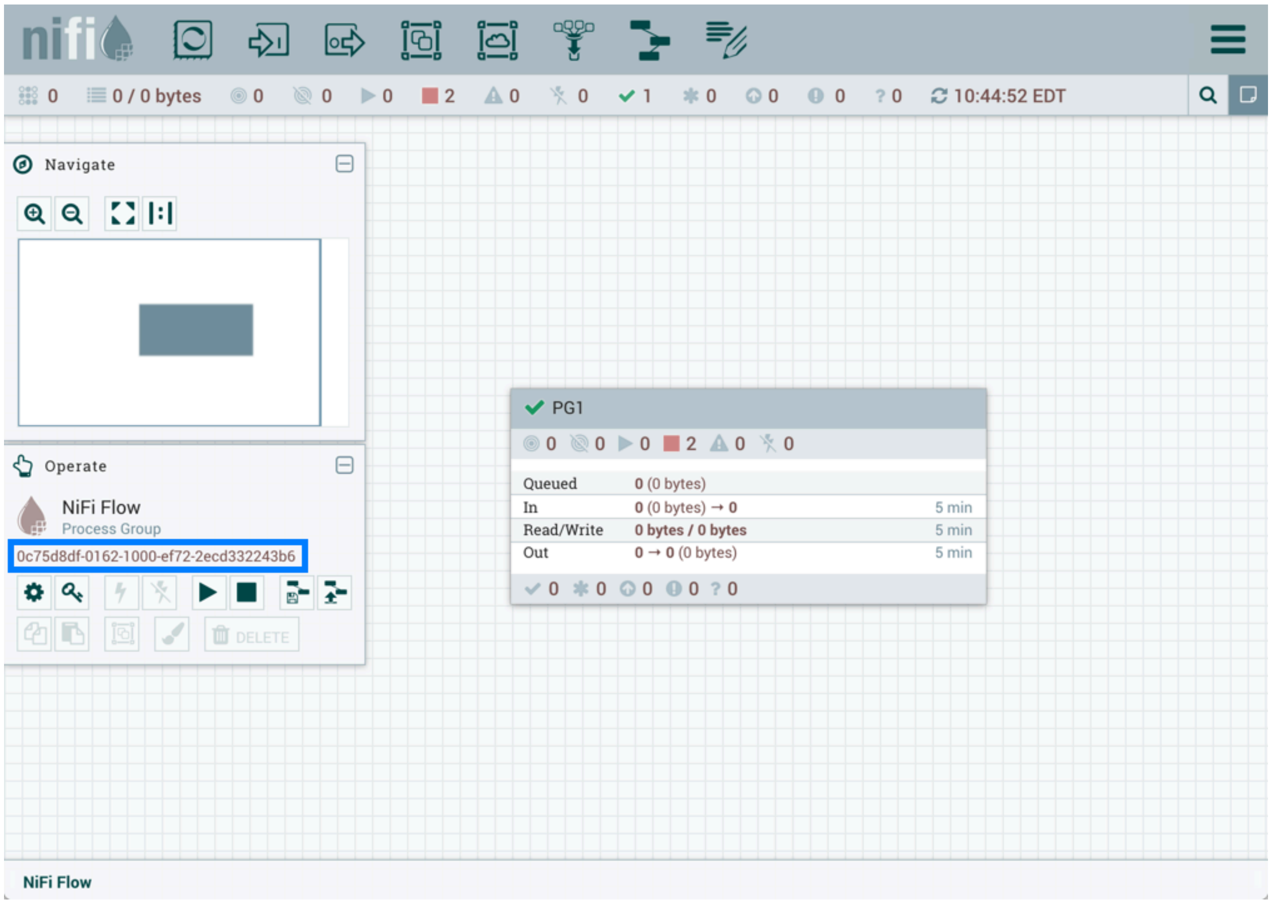
the added GetFile processor will also reference the "RPG_Var" variable that exists in the root process group:



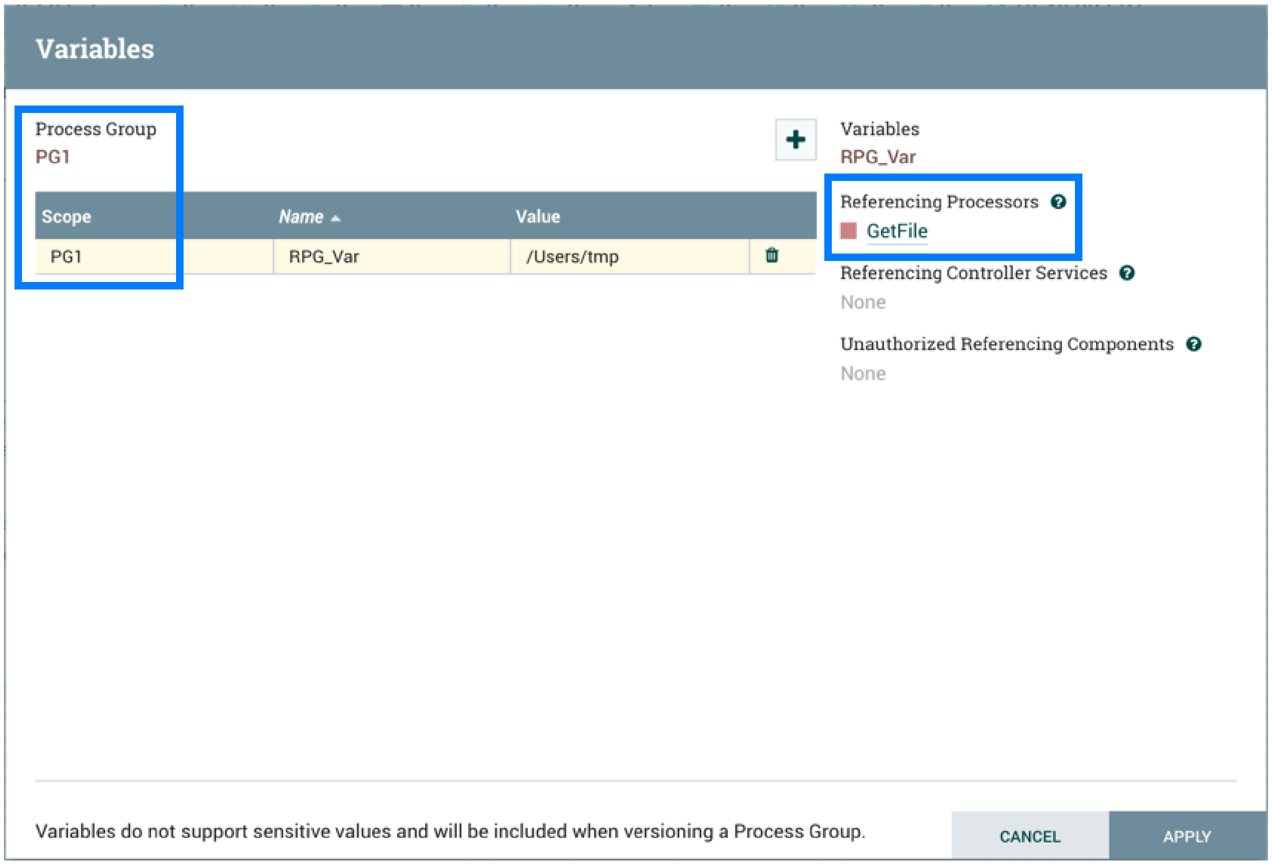
Scope	Name	Value
NiFi Flow	RPG_Var	/Users/tmp

Variables do not support sensitive values and will be included when versioning a Process Group.

If PG1 versioned flow is imported into a different NiFi instance where "RPG_Var" does not exist:



A "RPG_Var" variable is created in the PG1 process group:



Variables

Process Group
PG1

Scope	Name	Value
PG1	RPG_Var	/Users/tmp

Variables
RPG_Var

Referencing Processors
GetFile

Referencing Controller Services
None

Unauthorized Referencing Components
None

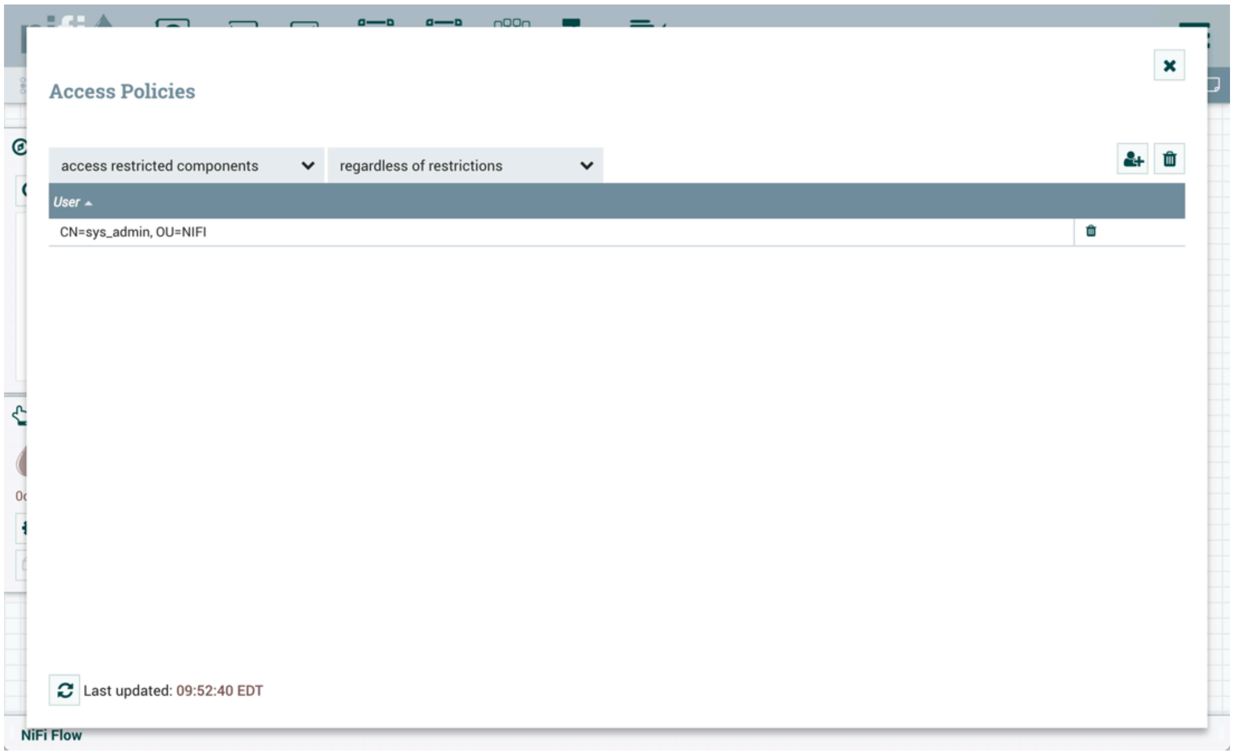
Variables do not support sensitive values and will be included when versioning a Process Group.

Restricted Components in Versioned Flows

To import a versioned flow or revert local changes in a versioned flow, a user must have access to all the components in the versioned flow. As such, it is recommended that restricted components are created at the root process group level if they are to be utilized in versioned flows. Let's walk through some examples to illustrate the benefits of this configuration. Assume the following:

- There are two users, "sys_admin" and "test_user" who have access to both view and modify the root process group.

- "sys_admin" has access to all restricted components.



Access Policies

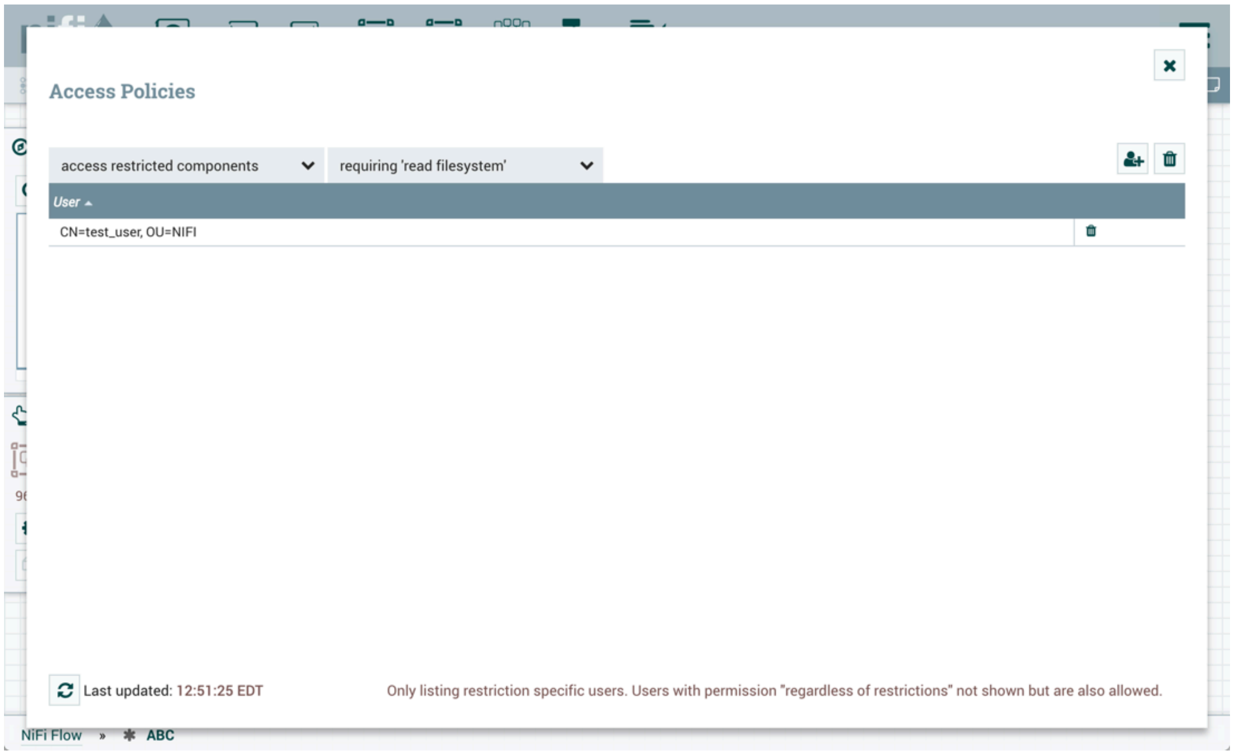
access restricted components | regardless of restrictions

User
CN=sys_admin, OU=NIFI

Last updated: 09:52:40 EDT

NiFi Flow

- "test_user" has access to restricted components requiring 'read filesystem' and 'write filesystem'.



Access Policies

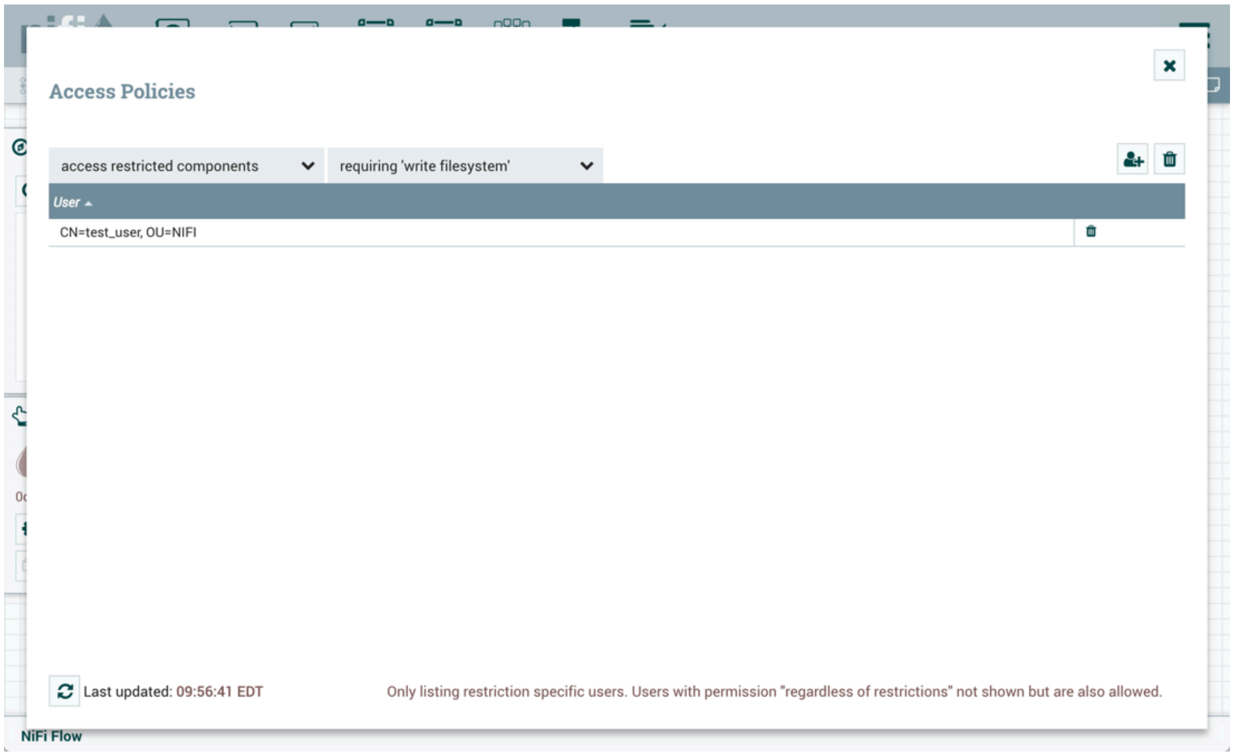
access restricted components | requiring 'read filesystem'

User
CN=test_user, OU=NIFI

Last updated: 12:51:25 EDT

Only listing restriction specific users. Users with permission "regardless of restrictions" not shown but are also allowed.

NiFi Flow » ABC



Access Policies

access restricted components | requiring 'write filesystem'

User
CN=test_user, OU=NIFI

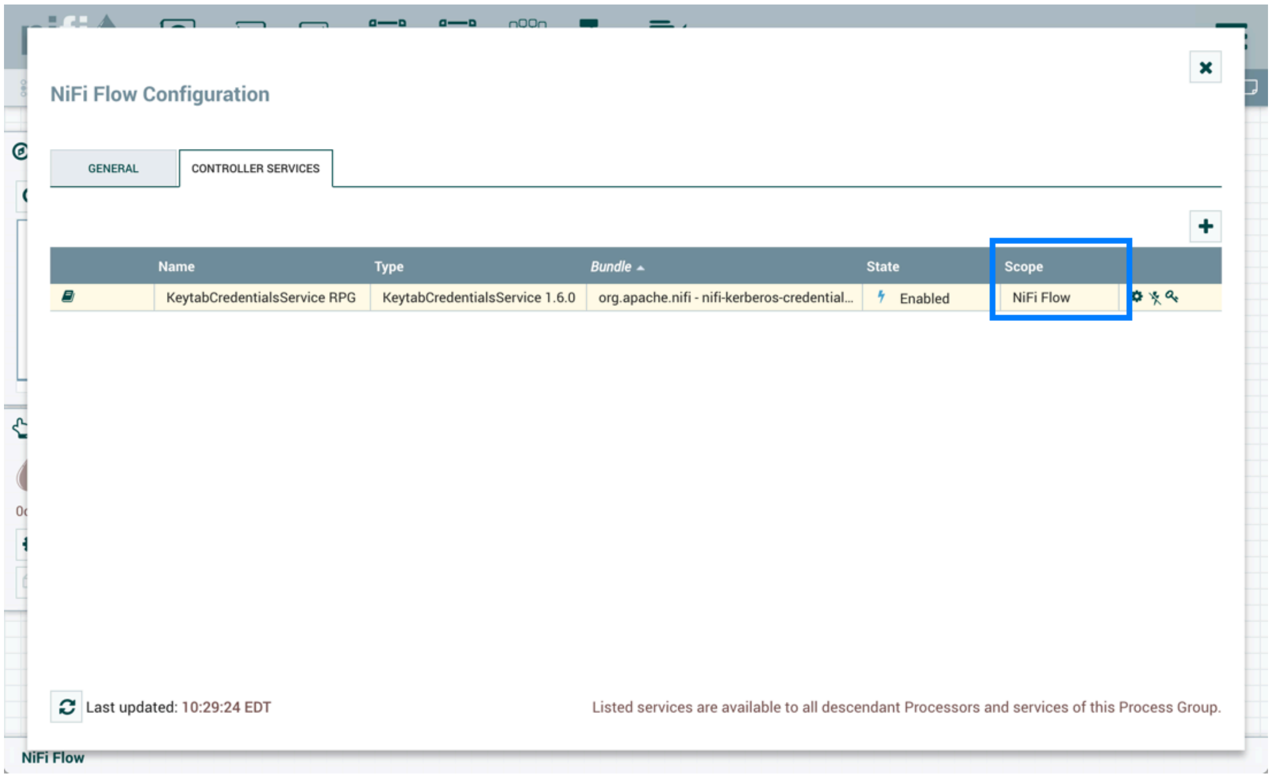
Last updated: 09:56:41 EDT

Only listing restriction specific users. Users with permission "regardless of restrictions" not shown but are also allowed.

NiFi Flow

Restricted Controller Service Created in Root Process Group

In this first example, sys_admin creates a KeytabCredentialsService controller service at the root process group level.



NiFi Flow Configuration

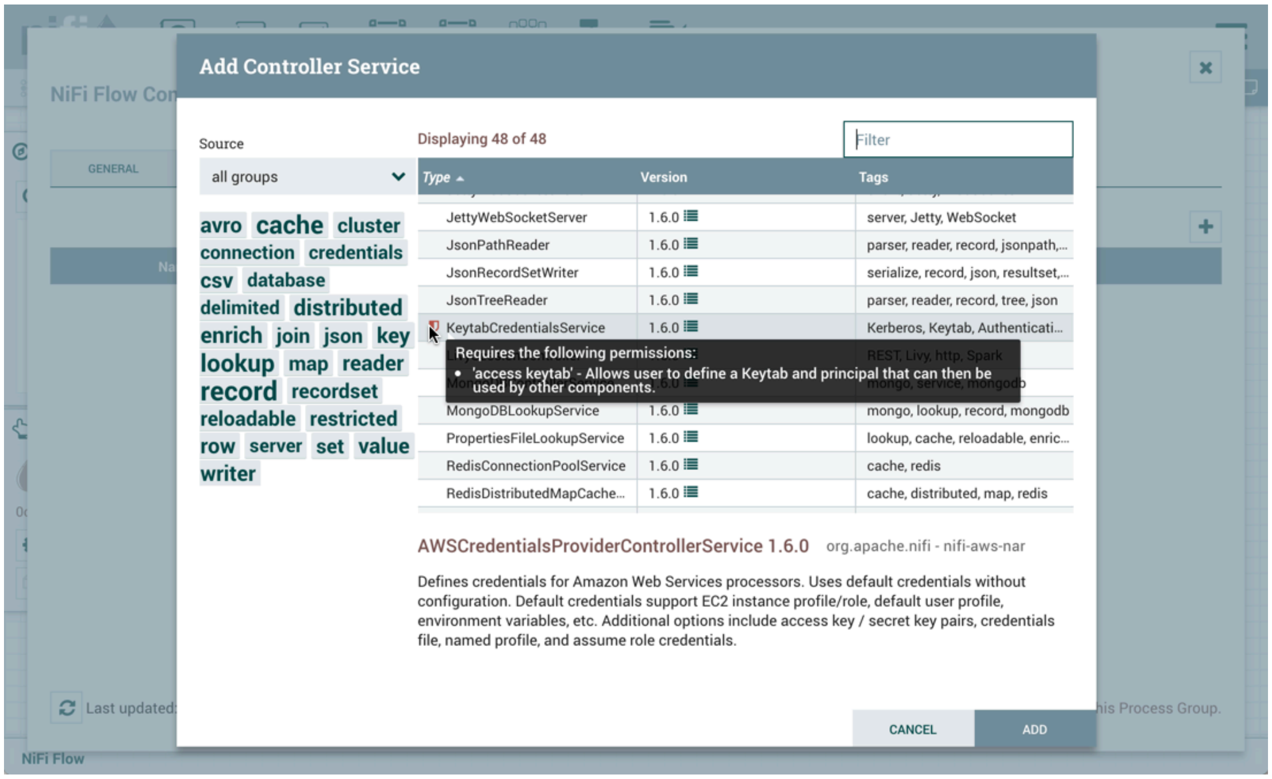
GENERAL | CONTROLLER SERVICES

	Name	Type	Bundle	State	Scope
	KeytabCredentialsService RPG	KeytabCredentialsService 1.6.0	org.apache.nifi - nifi-kerberos-credential...	Enabled	NiFi Flow

Last updated: 10:29:24 EDT

Listed services are available to all descendant Processors and services of this Process Group.

KeytabCredentialService controller service is a restricted component that requires 'access keytab' permissions:



Add Controller Service

Source: all groups

Displaying 48 of 48

Type	Version	Tags
JettyWebSocketServer	1.6.0	server, Jetty, WebSocket
JsonPathReader	1.6.0	parser, reader, record, jsonpath,...
JsonRecordSetWriter	1.6.0	serialize, record, json, resultset,...
JsonTreeReader	1.6.0	parser, reader, record, tree, json
KeytabCredentialsService	1.6.0	Kerberos, Keytab, Authenticati...
MongoDBLookupService	1.6.0	mongo, lookup, record, mongodb
PropertiesFileLookupService	1.6.0	lookup, cache, reloadable, enric...
RedisConnectionPoolService	1.6.0	cache, redis
RedisDistributedMapCache...	1.6.0	cache, distributed, map, redis

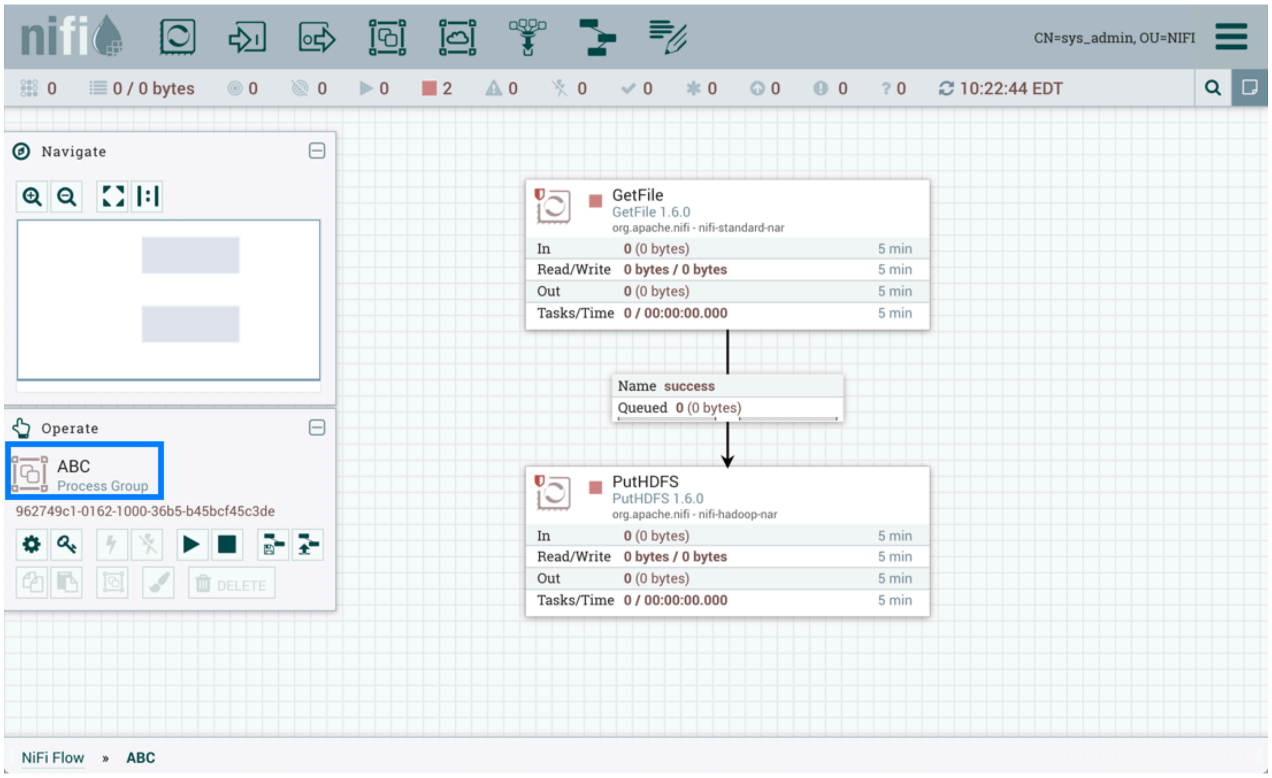
Requires the following permissions:
- 'access keytab' - Allows user to define a Keytab and principal that can then be used by other components.

AWSCredentialsProviderControllerService 1.6.0 org.apache.nifi - nifi-aws-nar

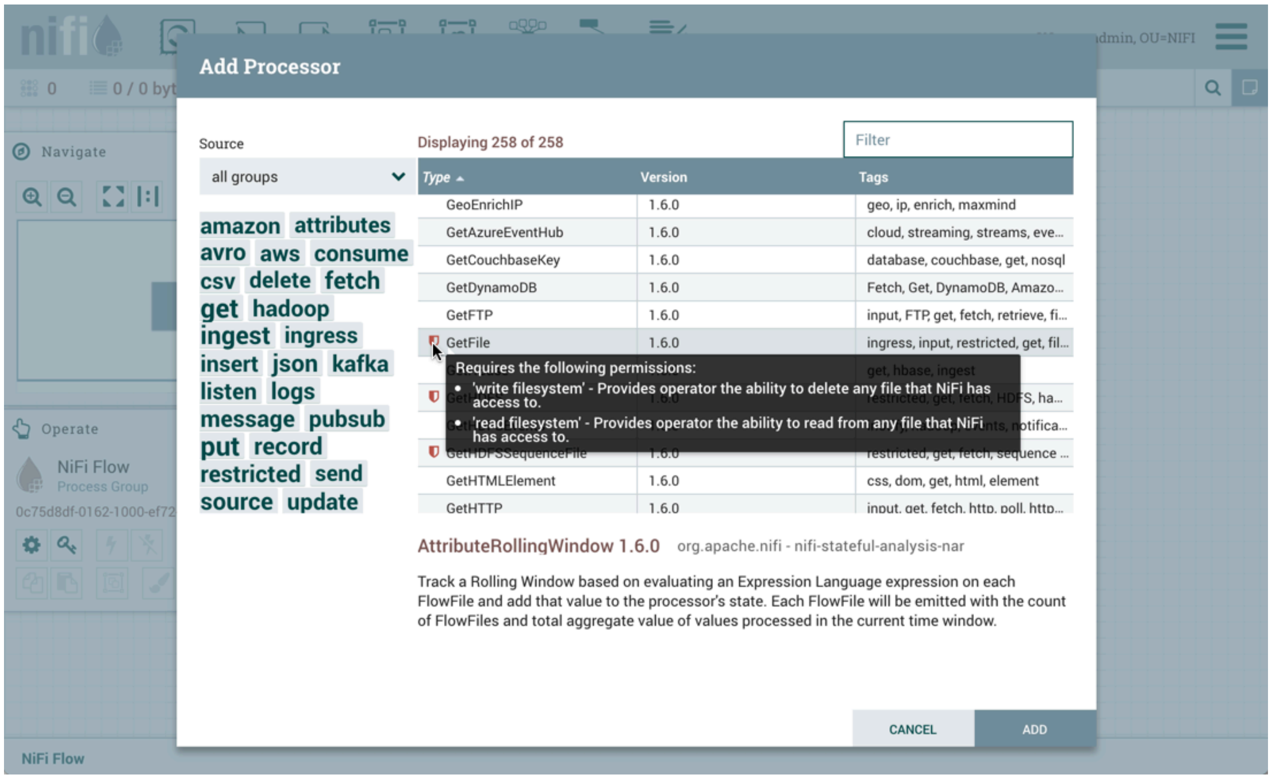
Defines credentials for Amazon Web Services processors. Uses default credentials without configuration. Default credentials support EC2 instance profile/role, default user profile, environment variables, etc. Additional options include access key / secret key pairs, credentials file, named profile, and assume role credentials.

avro cache cluster connection credentials csv database delimited distributed enrich join json key lookup map reader record recordset reloadable restricted row server set value writer
CANCEL
ADD

Sys_admin creates a process group ABC containing a flow with GetFile and PutHDFS processors:


CN=sys_admin, OU=NIFI
0 0 / 0 bytes 0 0 0 2 0 0 0 0 0 0 0 10:22:44 EDT
Navigate
Operate
ABC
Process Group
962749c1-0162-1000-36b5-b45bcf45c3de
DELETE
GetFile
GetFile 1.6.0
org.apache.nifi - nifi-standard-nar
In 0 (0 bytes) 5 min
Read/Write 0 bytes / 0 bytes 5 min
Out 0 (0 bytes) 5 min
Tasks/Time 0 / 00:00:00.000 5 min
Name success
Queued 0 (0 bytes)
PutHDFS
PutHDFS 1.6.0
org.apache.nifi - nifi-hadoop-nar
In 0 (0 bytes) 5 min
Read/Write 0 bytes / 0 bytes 5 min
Out 0 (0 bytes) 5 min
Tasks/Time 0 / 00:00:00.000 5 min
NiFi Flow » ABC

GetFile processor is a restricted component that requires 'write filesystem' and 'read filesystem' permissions:


Add Processor
Source
all groups
amazon attributes avro aws consume csv delete fetch get hadoop ingest ingress insert json kafka listen logs message pubsub put record restricted send source update
Filter
CANCEL
ADD

Displaying 258 of 258

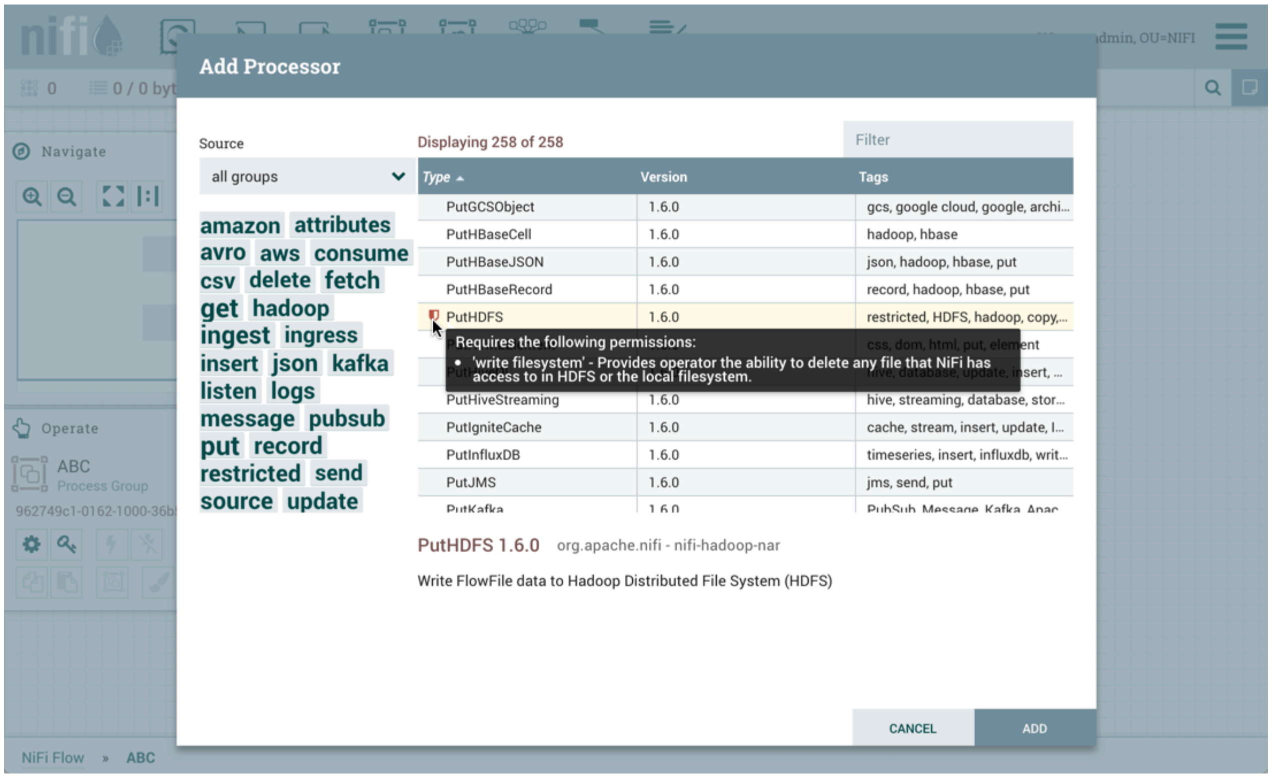
Type	Version	Tags
GeoEnrichIP	1.6.0	geo, ip, enrich, maxmind
GetAzureEventHub	1.6.0	cloud, streaming, streams, eve...
GetCouchbaseKey	1.6.0	database, couchbase, get, nosql
GetDynamoDB	1.6.0	Fetch, Get, DynamoDB, Amazo...
GetFTP	1.6.0	input, FTP, get, fetch, retrieve, fi...
GetFile	1.6.0	ingress, input, restricted, get, fil...
GetHTMLElement	1.6.0	css, dom, get, html, element
GetHTTP	1.6.0	input, get, fetch, http, poll, http...

Requires the following permissions:
- 'write filesystem' - Provides operator the ability to delete any file that NiFi has access to.
- 'read filesystem' - Provides operator the ability to read from any file that NiFi has access to.

AttributeRollingWindow 1.6.0 org.apache.nifi - nifi-stateful-analysis-nar

Track a Rolling Window based on evaluating an Expression Language expression on each FlowFile and add that value to the processor's state. Each FlowFile will be emitted with the count of FlowFiles and total aggregate value of values processed in the current time window.

PutHDFS is a restricted component that requires 'write filesystem' permissions:


Add Processor

Source: all groups

Displaying 258 of 258

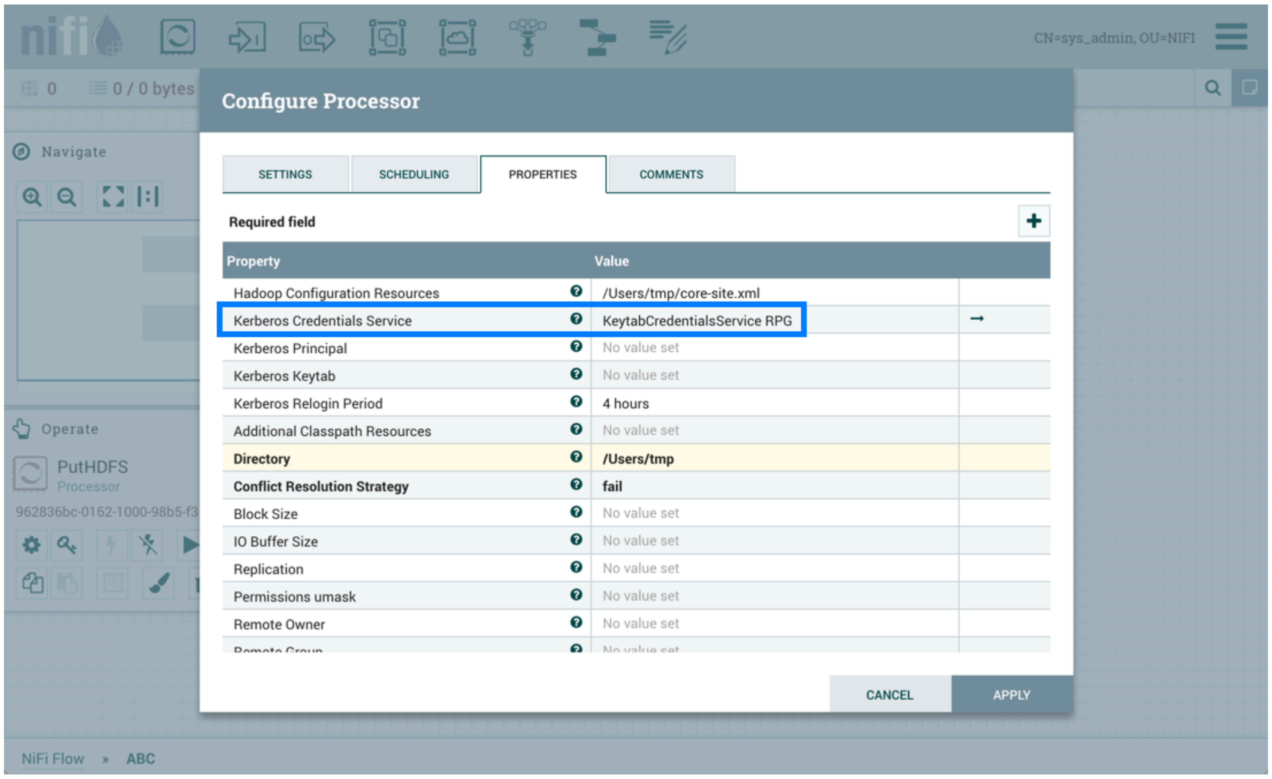
Type	Version	Tags
PutGCSObject	1.6.0	gcs, google cloud, google, archi...
PutHBaseCell	1.6.0	hadoop, hbase
PutHBaseJSON	1.6.0	json, hadoop, hbase, put
PutHBaseRecord	1.6.0	record, hadoop, hbase, put
PutHDFS	1.6.0	restricted, HDFS, hadoop, copy,...
PutHiveStreaming	1.6.0	hive, streaming, database, stor...
PutIgniteCache	1.6.0	cache, stream, insert, update, I...
PutInfluxDB	1.6.0	timeseries, insert, influxdb, writ...
PutJMS	1.6.0	jms, send, put

Requires the following permissions:
- 'write filesystem' - Provides operator the ability to delete any file that NiFi has access to in HDFS or the local filesystem.

PutHDFS 1.6.0 org.apache.nifi - nifi-hadoop-nar

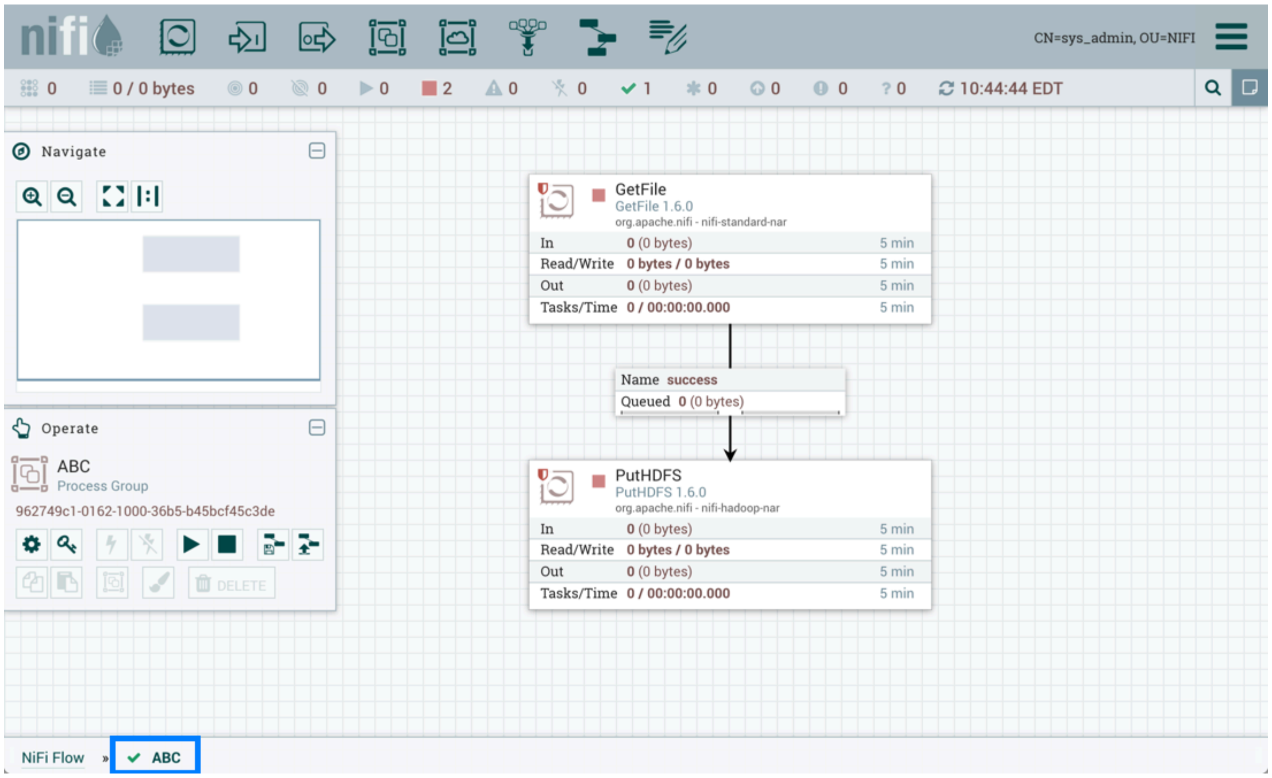
Write FlowFile data to Hadoop Distributed File System (HDFS)

The PutHDFS processor is configured to use the root process group level KeytabCredentialsService controller service:


Configure Processor

Property	Value
Hadoop Configuration Resources	/Users/tmp/core-site.xml
Kerberos Credentials Service	KeytabCredentialsService RPG
Kerberos Principal	No value set
Kerberos Keytab	No value set
Kerberos Relogin Period	4 hours
Additional Classpath Resources	No value set
Directory	**/Users/tmp**
Conflict Resolution Strategy	**fail**
Block Size	No value set
IO Buffer Size	No value set
Replication	No value set
Permissions umask	No value set
Remote Owner	No value set

Sys_admin saves the process group as a versioned flow:



ABC
Process Group
962749c1-0162-1000-36b5-b45bcf45c3de

GetFile
GetFile 1.6.0
org.apache.nifi - nifi-standard-nar

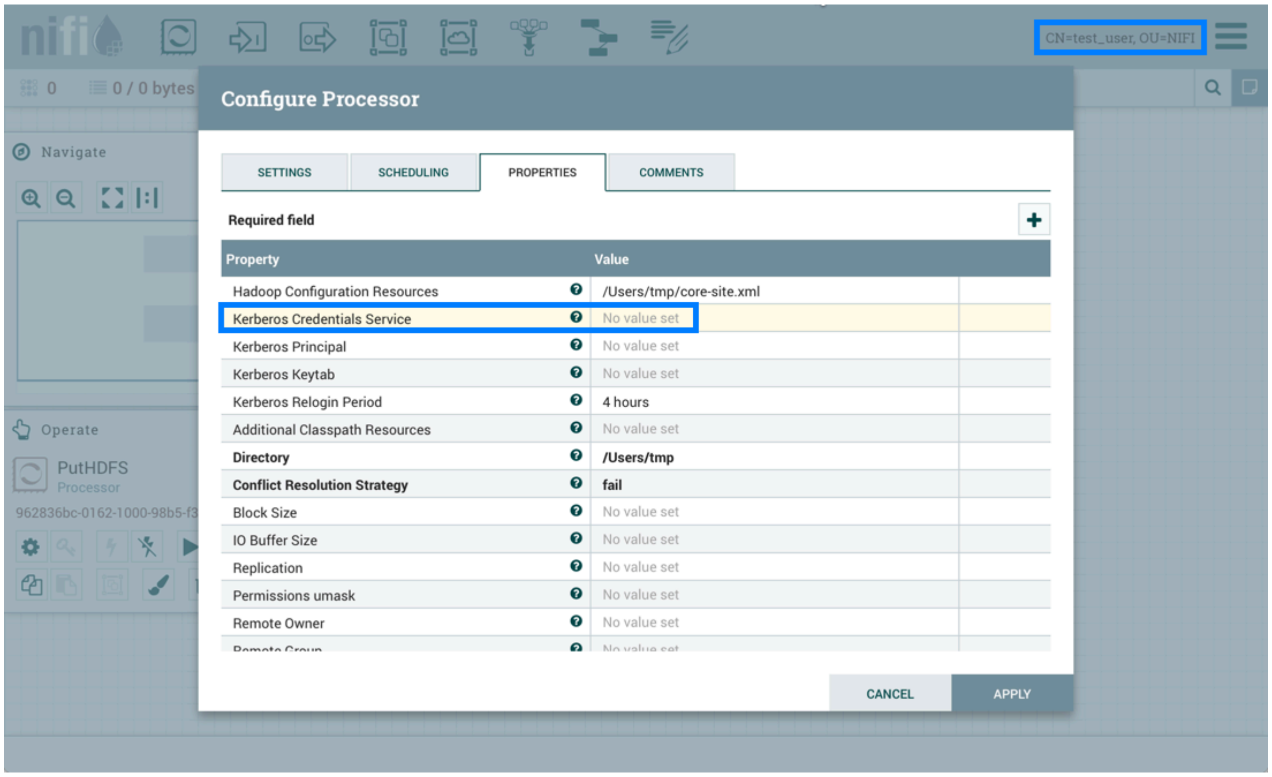
In	0 (0 bytes)	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 (0 bytes)	5 min
Tasks/Time	0 / 00:00:00.000	5 min

Name success
Queued 0 (0 bytes)

PutHDFS
PutHDFS 1.6.0
org.apache.nifi - nifi-hadoop-nar

In	0 (0 bytes)	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 (0 bytes)	5 min
Tasks/Time	0 / 00:00:00.000	5 min

Test_user changes the flow by removing the KeytabCredentialsService controller service:

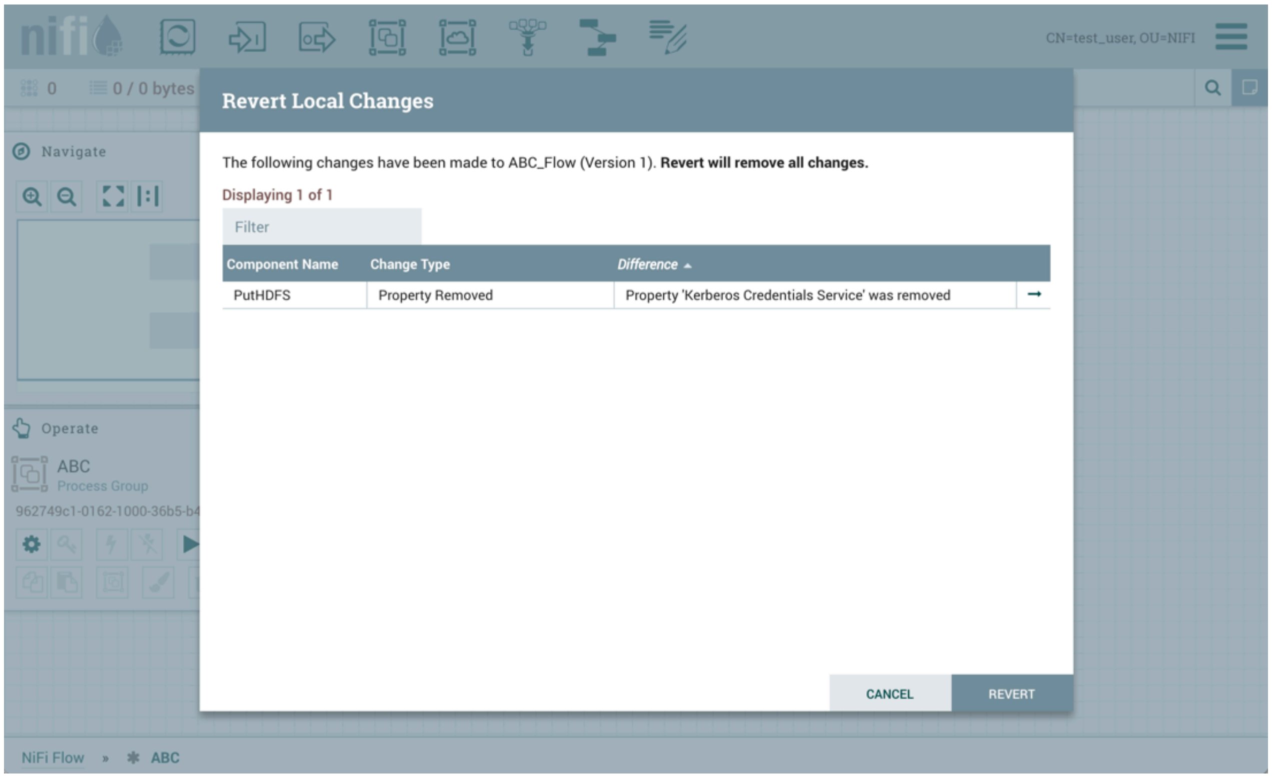


Configure Processor

Required field

Property	Value
Hadoop Configuration Resources	/Users/tmp/core-site.xml
Kerberos Credentials Service	No value set
Kerberos Principal	No value set
Kerberos Keytab	No value set
Kerberos Relogin Period	4 hours
Additional Classpath Resources	No value set
Directory	**/Users/tmp**
Conflict Resolution Strategy	**fail**
Block Size	No value set
IO Buffer Size	No value set
Replication	No value set
Permissions umask	No value set
Remote Owner	No value set
Remote Group	No value set

If test_user chooses to revert this change:

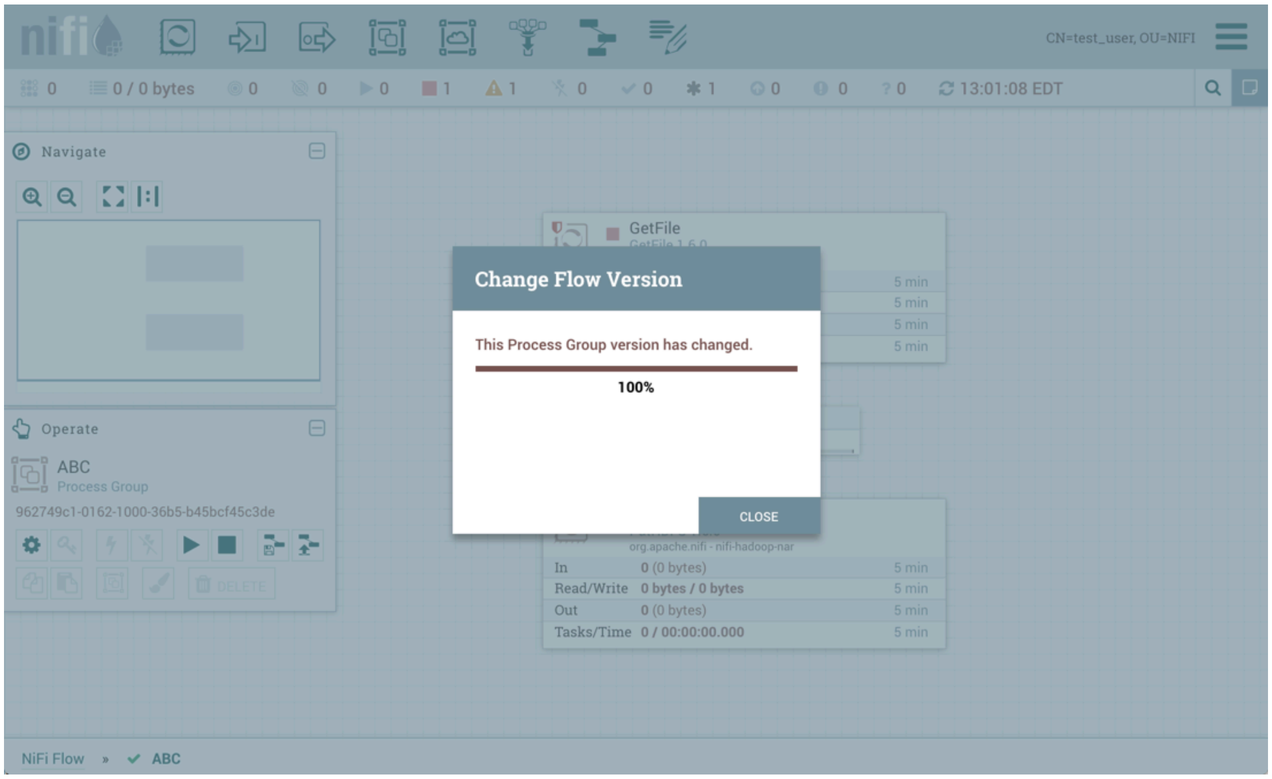


The following changes have been made to ABC_Flow (Version 1). **Revert will remove all changes.**

Displaying 1 of 1

Component Name	Change Type	Difference
PutHDFS	Property Removed	Property 'Kerberos Credentials Service' was removed

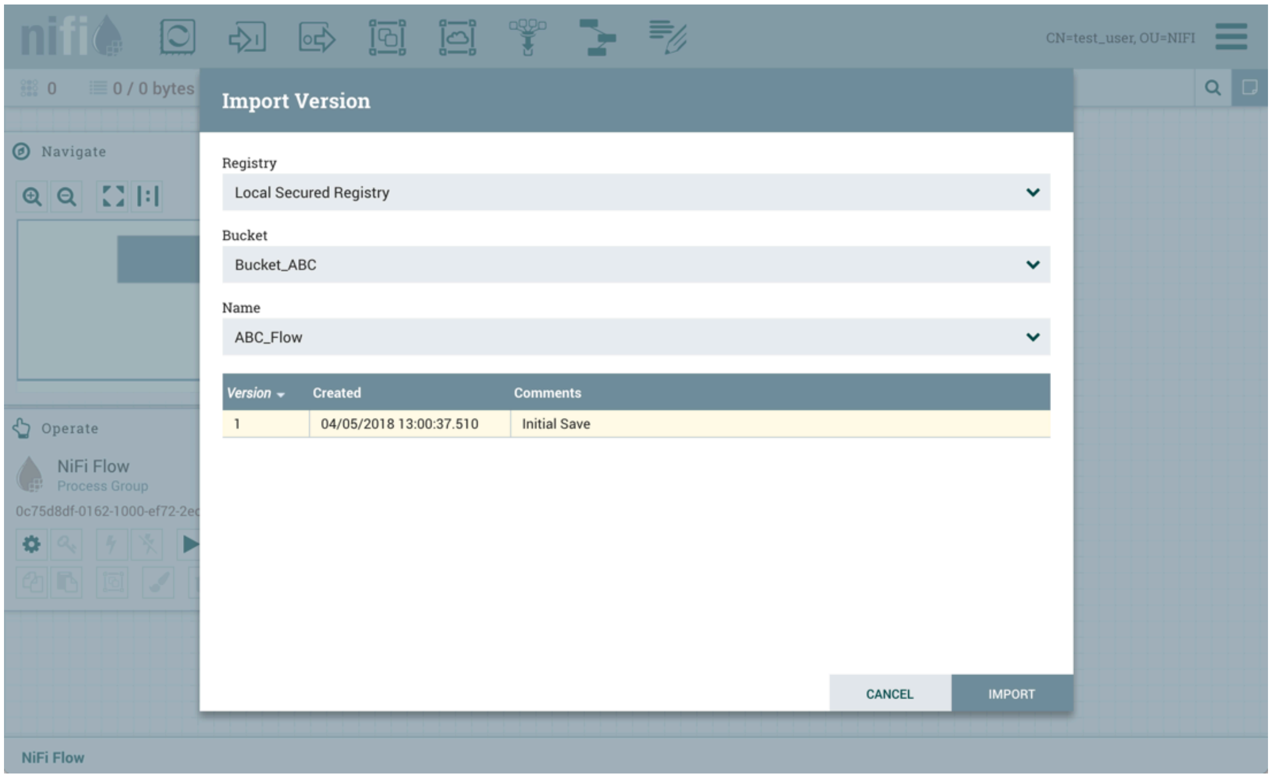
the revert is successful:



This Process Group version has changed.

100%

Additionally, if test_user chooses to import the ABC versioned flow:



Import Version

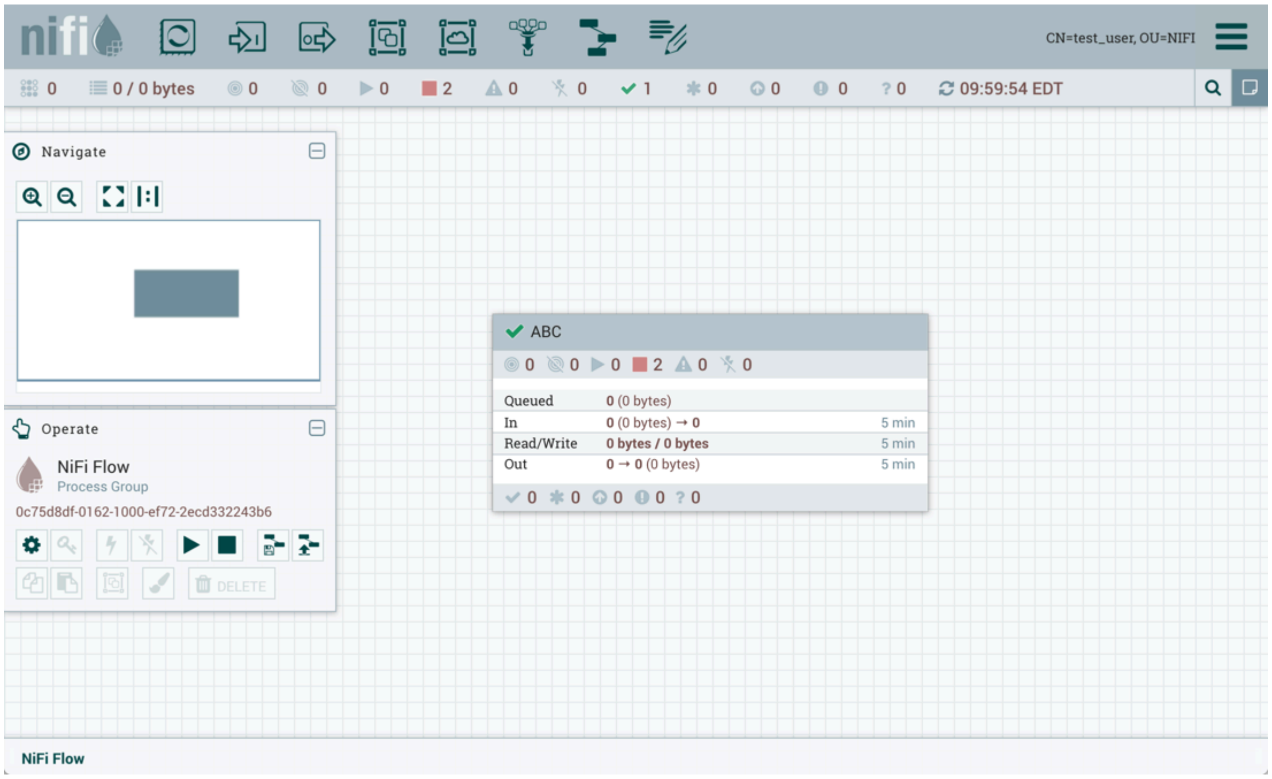
Registry: Local Secured Registry

Bucket: Bucket_ABC

Name: ABC_Flow

Version	Created	Comments
1	04/05/2018 13:00:37.510	Initial Save

The import is successful:

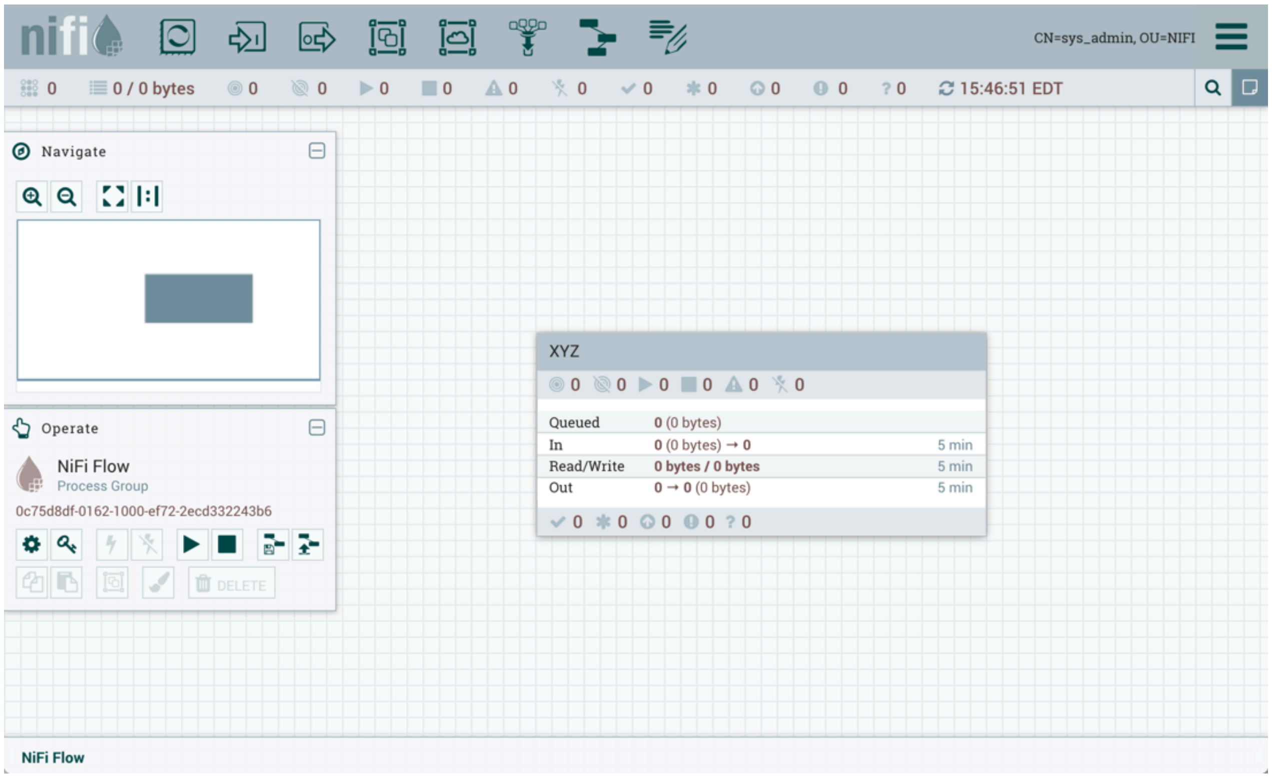


Queued	0 (0 bytes)	
In	0 (0 bytes) → 0	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 → 0 (0 bytes)	5 min

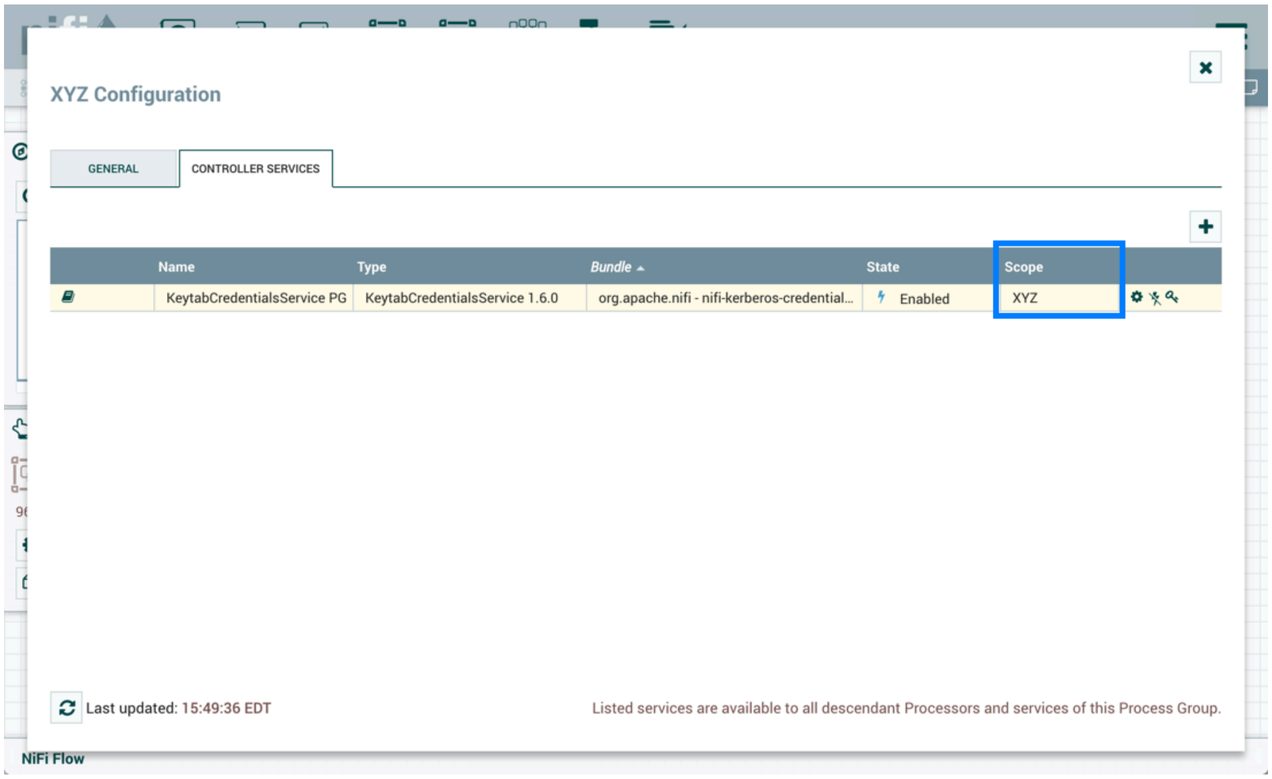
Restricted Controller Service Created in Process Group

Now, consider a second scenario where the controller service is created on the process group level.

Sys_admin creates a process group XYZ:



Sys_admin creates a KeytabCredentialsService controller service at the process group level:

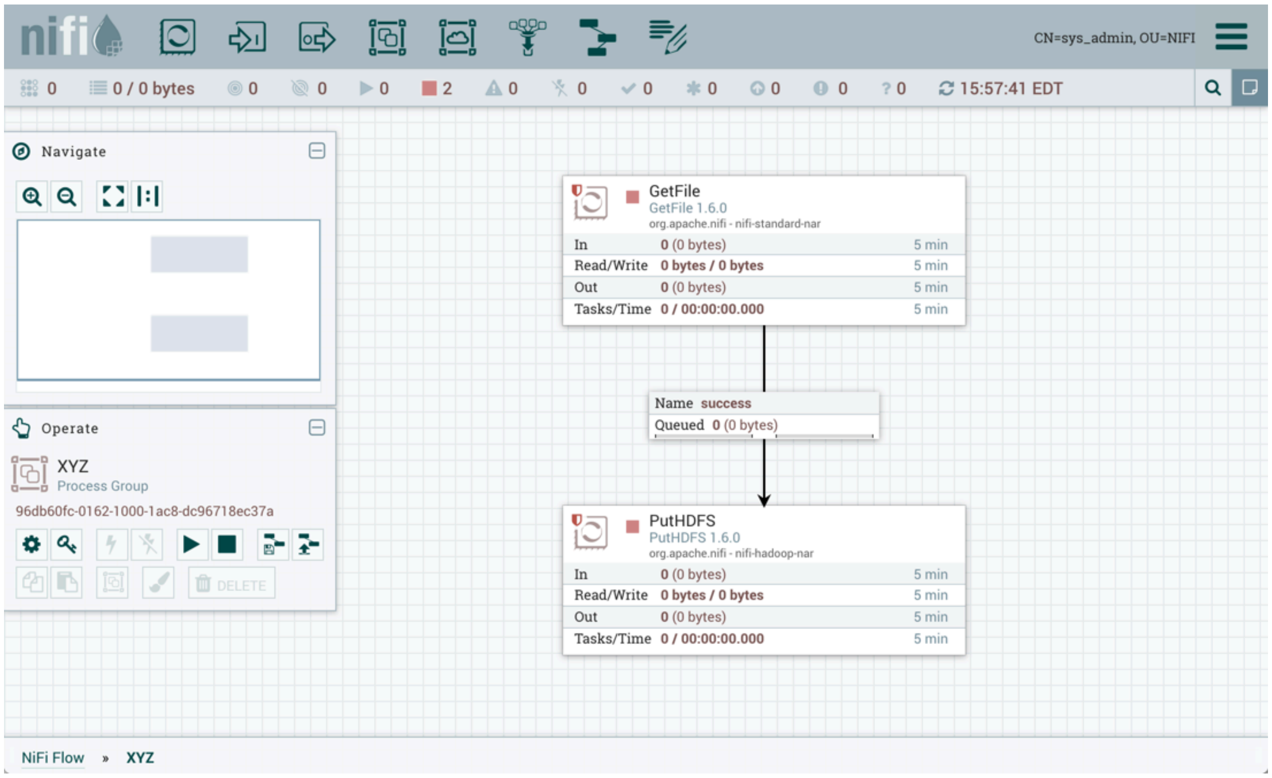


Name	Type	Bundle	State	Scope
KeytabCredentialsService PG	KeytabCredentialsService 1.6.0	org.apache.nifi - nifi-kerberos-credential...	Enabled	XYZ

Last updated: 15:49:36 EDT

Listed services are available to all descendant Processors and services of this Process Group.

The same GetFile and PutHDFS flow is created in the process group:


CN=sys_admin, OU=NIFI

0 | 0 / 0 bytes | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15:57:41 EDT

Navigate

Operate

XYZ
Process Group
96db60fc-0162-1000-1ac8-dc96718ec37a

GetFile
GetFile 1.6.0
org.apache.nifi - nifi-standard-nar

In	0 (0 bytes)	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 (0 bytes)	5 min
Tasks/Time	0 / 00:00:00.000	5 min

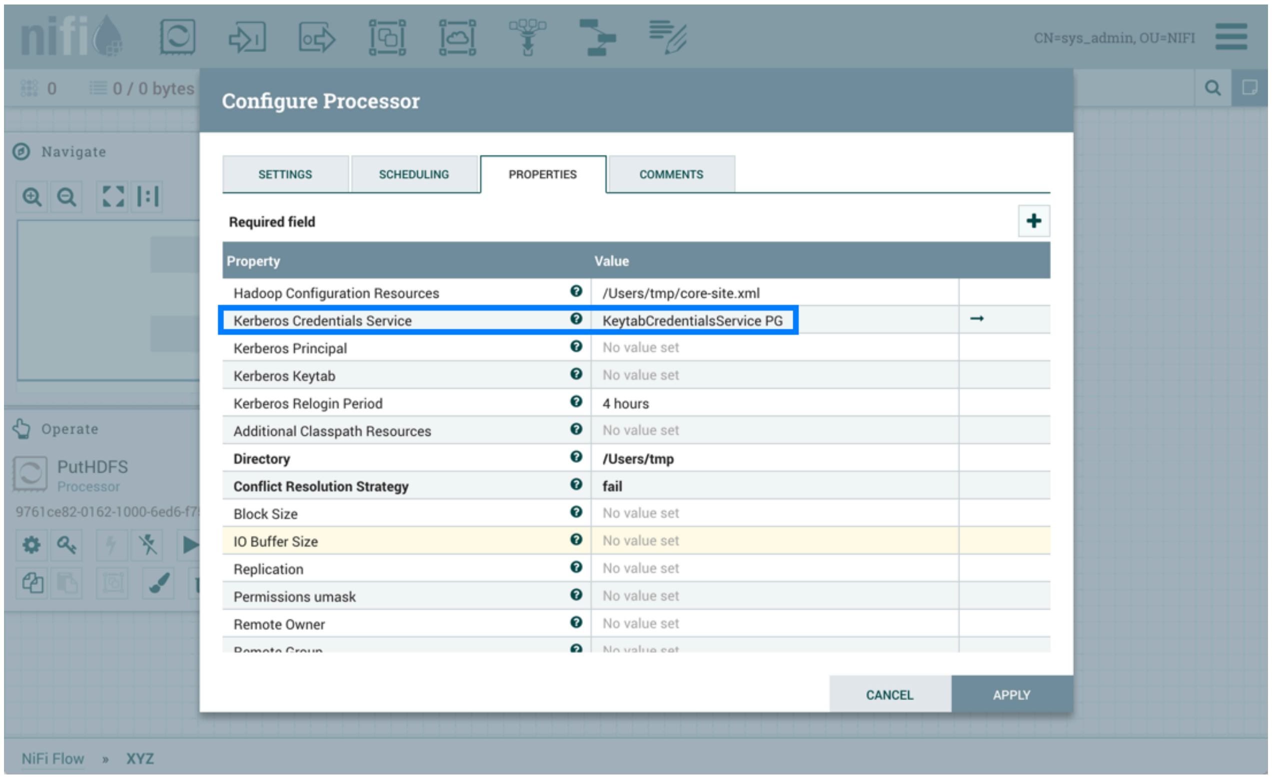
Name success
Queued 0 (0 bytes)

PutHDFS
PutHDFS 1.6.0
org.apache.nifi - nifi-hadoop-nar

In	0 (0 bytes)	5 min
Read/Write	0 bytes / 0 bytes	5 min
Out	0 (0 bytes)	5 min
Tasks/Time	0 / 00:00:00.000	5 min

NiFi Flow » XYZ

However, PutHDFS now references the process group level controller service:


Configure Processor

SETTINGS | SCHEDULING | PROPERTIES | COMMENTS

Required field

Property	Value
Hadoop Configuration Resources	/Users/tmp/core-site.xml
Kerberos Credentials Service	KeytabCredentialsService PG
Kerberos Principal	No value set
Kerberos Keytab	No value set
Kerberos Relogin Period	4 hours
Additional Classpath Resources	No value set
Directory	**/Users/tmp**
Conflict Resolution Strategy	**fail**
Block Size	No value set
IO Buffer Size	No value set
Replication	No value set
Permissions umask	No value set
Remote Owner	No value set
Remote Group	No value set

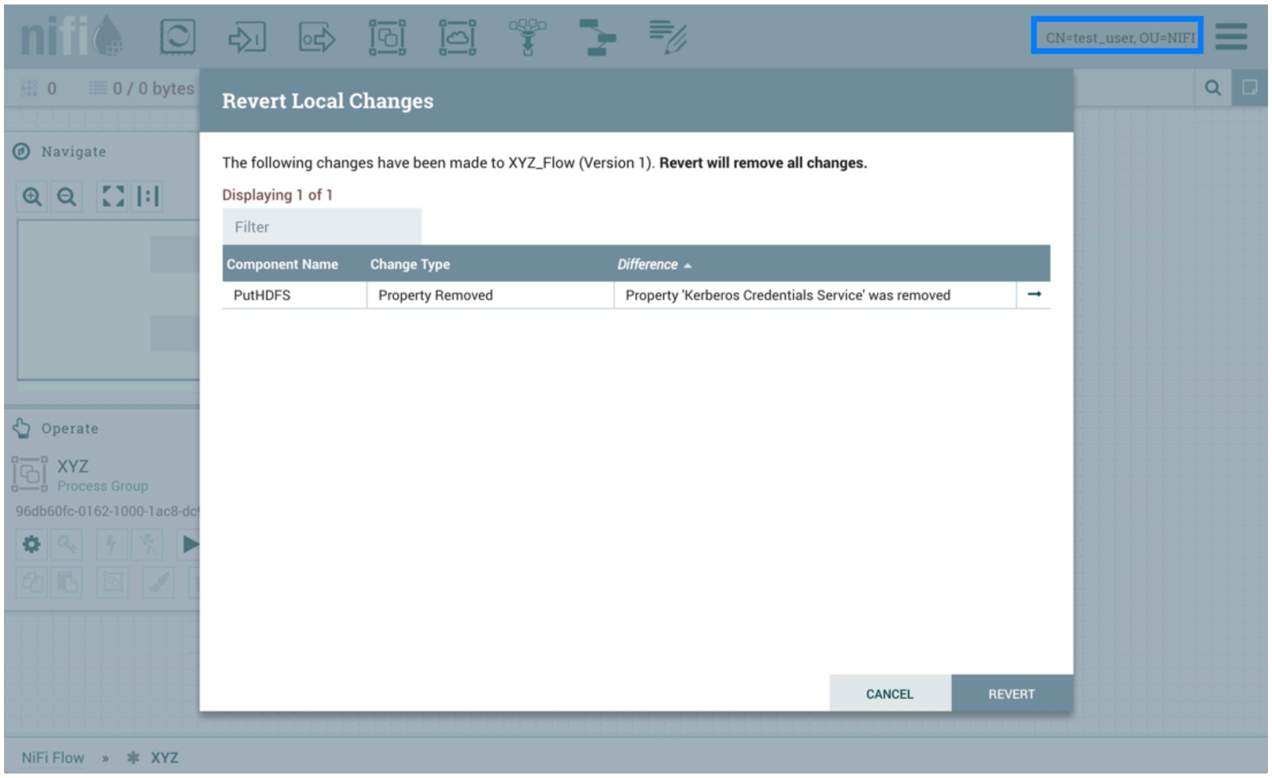
CANCEL APPLY

PutHDFS
Processor
9761ce82-0162-1000-6ed6-f7

NiFi Flow » XYZ

Sys_admin saves the process group as a versioned flow.

Test_user changes the flow by removing the KeytabCredentialsService controller service. However, with this configuration, if test_user attempts to revert this change:



Revert Local Changes

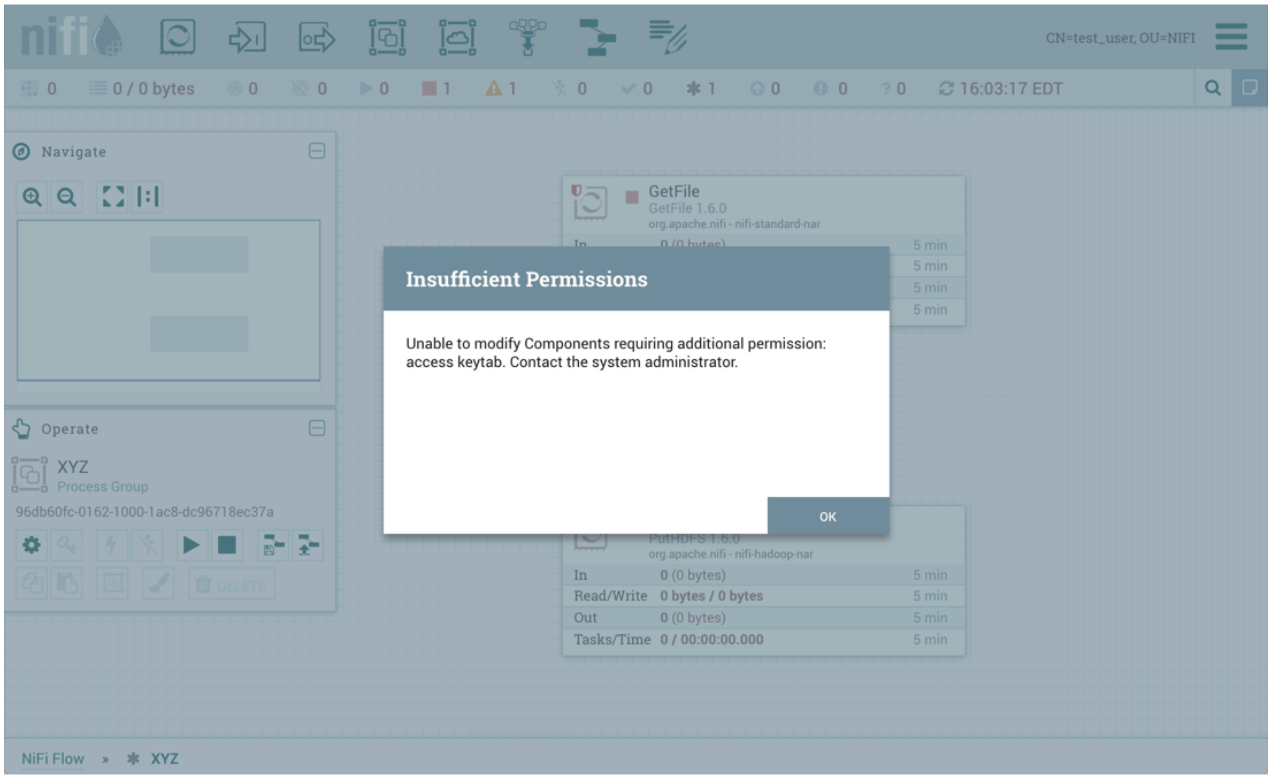
The following changes have been made to XYZ_Flow (Version 1). **Revert will remove all changes.**

Displaying 1 of 1

Component Name	Change Type	Difference
PutHDFS	Property Removed	Property 'Kerberos Credentials Service' was removed

CANCEL REVERT

the revert is unsuccessful because test_user does not have the 'access keytab' permissions required by the KeytabCredentialService controller service:

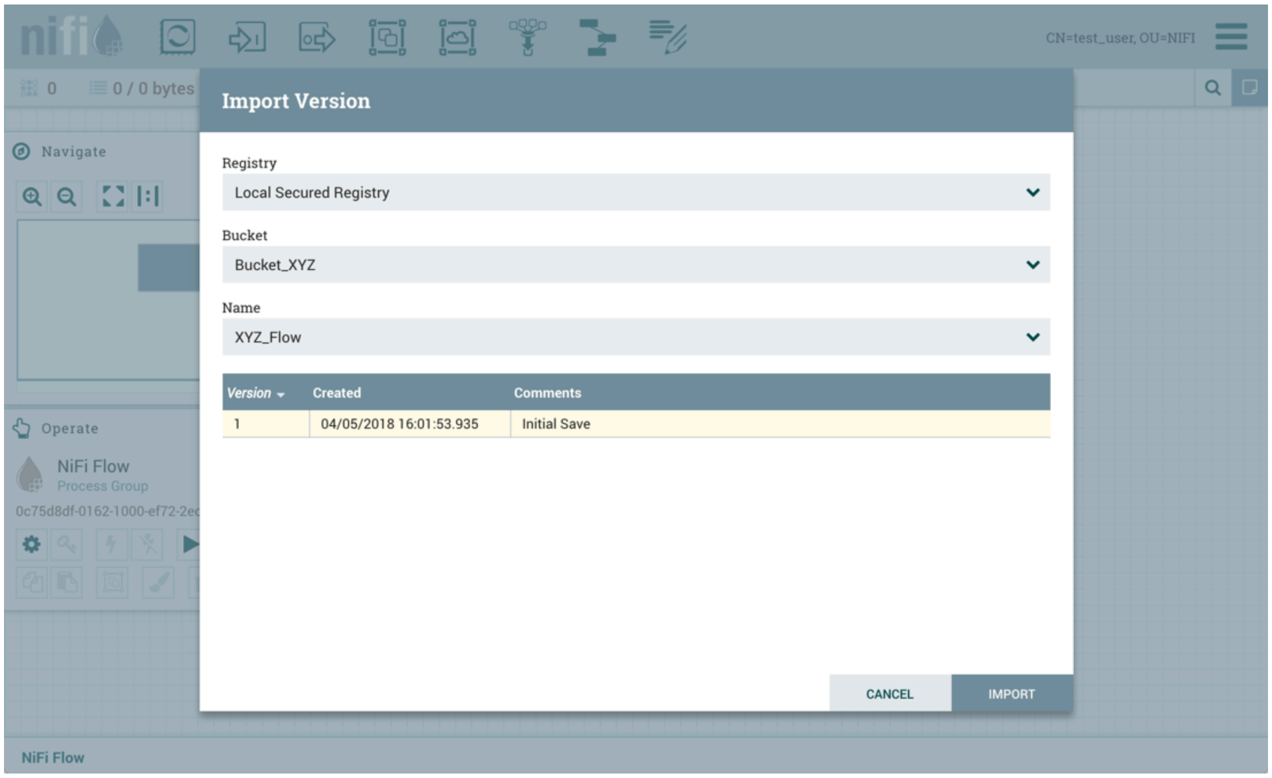

CN=test_user, OU=NIFI
16:03:17 EDT
Navigate
Operate
XYZ
Process Group
96db60fc-0162-1000-1ac8-dc96718ec37a
GetFile
GetFile 1.6.0
org.apache.nifi - nifi-standard-nar
PutHDFS 1.6.0
org.apache.nifi - nifi-hadoop-nar
In 0 (0 bytes) 5 min
Read/Write 0 bytes / 0 bytes 5 min
Out 0 (0 bytes) 5 min
Tasks/Time 0 / 00:00:00.000 5 min
NiFi Flow » XYZ

Insufficient Permissions

Unable to modify Components requiring additional permission: access keytab. Contact the system administrator.

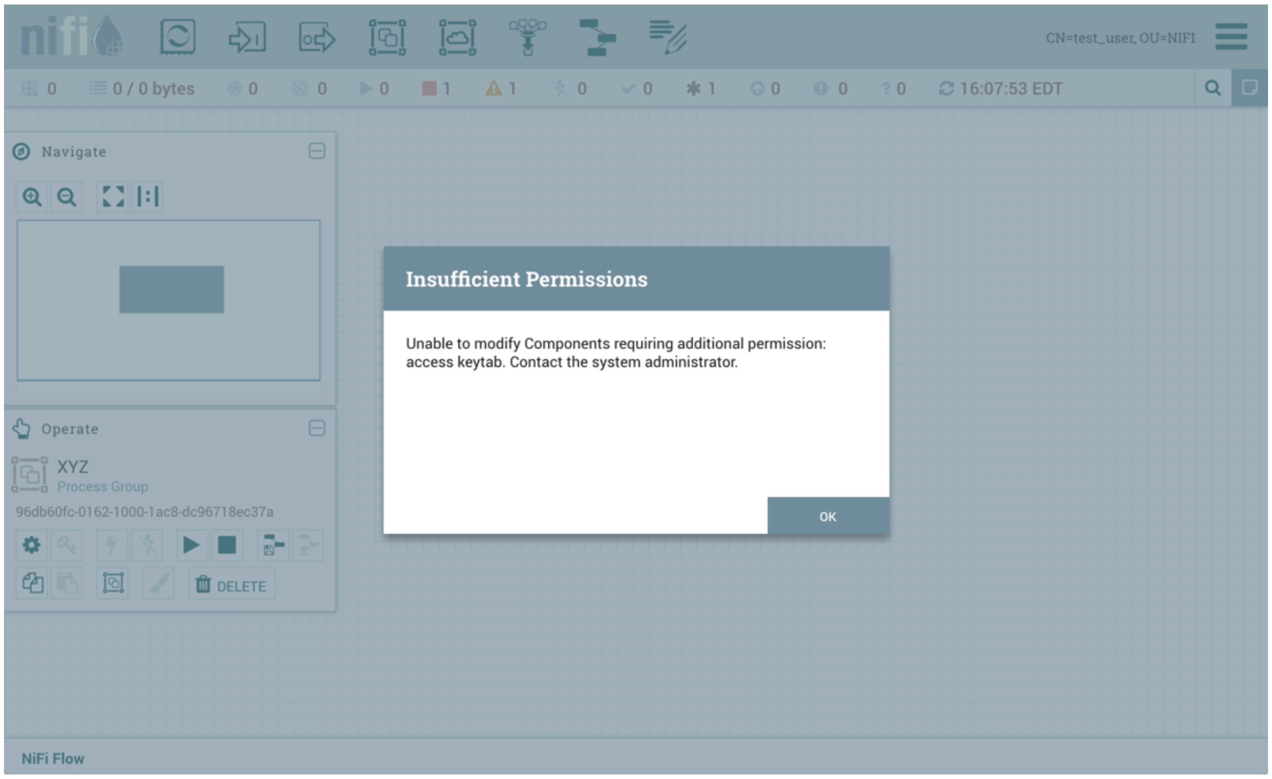
OK

Similarly, if test_user tries to import the XYZ versioned flow:



Version	Created	Comments
1	04/05/2018 16:01:53.935	Initial Save

The import fails:



Unable to modify Components requiring additional permission: access keytab. Contact the system administrator.

Templates

DFMs have the ability to build very large and complex DataFlows using NiFi. This is achieved by using the basic components: Processor, Funnel, Input/Output Port, Process Group, and Remote Process Group. These can be thought of as the most basic building blocks for constructing a DataFlow. At times, though, using these small building blocks can become tedious if the same logic needs to be repeated several times.

To solve this issue, NiFi provides the concept of a Template. A Template is a way of combining these basic building blocks into larger building blocks. Once a DataFlow has been created, parts of it can be formed into a Template. This Template can then be dragged onto the canvas, or can be exported as an XML file and shared with others. Templates received from others can then be imported into an instance of NiFi and dragged onto the canvas.

Creating a Template

To create a Template, select the components that are to be a part of the template, and then click the "Create Template" ( ) button in the Operate Palette (See NiFi User Interface for more information on the Operate Palette).

Clicking this button without selecting anything will create a Template that contains all of the contents of the current Process Group. This means that creating a Template with nothing selected while on the Root Process Group will create a single Template that contains the entire flow.

After clicking this button, the user is prompted to provide a name and an optional description for the template. Each template must have a unique name. After entering the name and optional description, clicking the "Create" button will generate the template and notify the user that the template was successfully created, or provide an appropriate error message if unable to create the template for some reason.

Note: It is important to note that if any Processor that is Templated has a sensitive property (such as a password), the value of that sensitive property is not included in the Template. As a result, when dragging the Template onto the canvas, newly created Processors may not be valid if they are missing values for their sensitive properties. Additionally, any Connection that was selected when making the Template is not included in the Template if either the source or the destination of the Connection is not also included in the Template.

Importing a Template

After receiving a Template that has been exported from another NiFi, the first step needed to use the template is to import the template into this instance of NiFi. You may import templates into any Process Group where you have the appropriate authorization.

From the Operate Palette, click the "Upload Template" ( ) button (see NiFi User Interface for more information on the Operate Palette). This will display the Upload Template dialog. Click the find icon and use the File Selection dialog to choose which template file to upload. Select the file and click Open. Clicking the "Upload" button will attempt to import the Template into this instance of NiFi. The Upload Template dialog will update to show "Success" or an error message if there was a problem importing the template.

Instantiating a Template

Once a Template has been created (see Creating a Template) or imported (see Importing a Template), it is ready to be instantiated, or added to the canvas. This is accomplished by dragging the Template icon ( ) from the Components Toolbar (see NiFi User Interface) onto the canvas.

This will present a dialog to choose which Template to add to the canvas. After choosing the Template to add, simply click the "Add" button. The Template will be added to the canvas with the upper-left-hand side of the Template being placed wherever the user dropped the Template icon.

This leaves the contents of the newly instantiated Template selected. If there was a mistake, and this Template is no longer wanted, it may be deleted.

Managing Templates

One of the most powerful features of NiFi Templates is the ability to easily export a Template to an XML file and to import a Template that has already been exported. This provides a very simple mechanism for sharing parts of a DataFlow with others. You can select Templates from the Global Menu (see NiFi User Interface) to open a dialog that displays all of the Templates that are currently available, filter the templates to see only those of interest, export, and delete Templates.

Exporting a Template

Once a Template has been created, it can be shared with others in the Template Management page. To export a Template, locate the Template in the table. The Filter in the top-right corner can be used to help find the appropriate Template if several are available. Then click the "Download" button ( ). This will download the template as an XML file to your computer. This XML file can then be sent to others and imported into other instances of NiFi (see Importing a Template).

Removing a Template

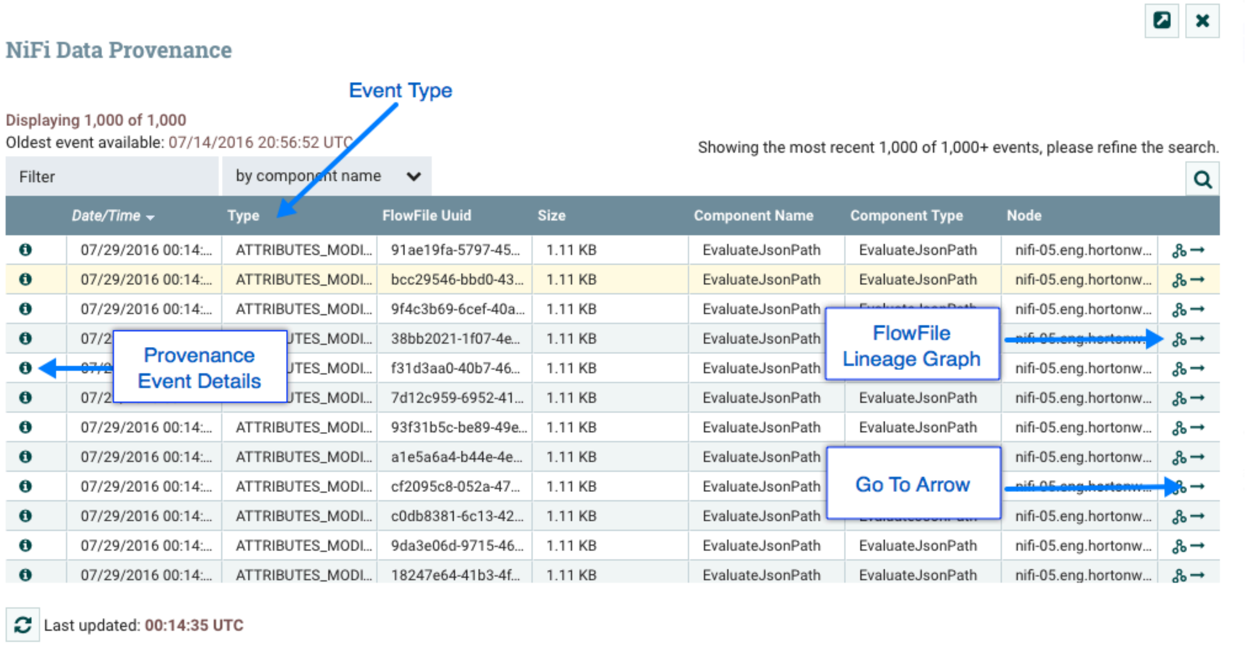
Once it is decided that a Template is no longer needed, it can be easily removed from the Template Management page. To delete a Template, locate it in the table (the Filter in the top-right corner may be used to find the appropriate Template if several are available) and click the "Delete" button ( ). This will prompt for confirmation. After confirming the deletion, the Template will be removed from this table and will no longer be available to add to the canvas.

Data Provenance

While monitoring a dataflow, users often need a way to determine what happened to a particular data object (FlowFile). NiFi's Data Provenance page provides that information. Because NiFi records and indexes data provenance details as objects flow through the system, users may perform searches, conduct troubleshooting and evaluate things like dataflow compliance and optimization in real time. By default, NiFi updates this information every five minutes, but that is configurable.

To access the Data Provenance page, select "Data Provenance" from the Global Menu. This opens a dialog window that allows the user to see the most recent Data Provenance information available, search the information for specific items, and filter the search results. It is also possible to open additional dialog windows to see event details, replay data at any point within the dataflow, and see a graphical representation of the data's lineage, or path through the flow. (These features are described in depth below.)

When authorization is enabled, accessessing Data Provenance information requires the 'query provenance' Global Policy as well as the 'view provenance' Component Policy for the component which generated the event. In addition, access to event details which include FlowFile attributes and content require the 'view the data' Component Policy for the component which generated the event.



Displaying 1,000 of 1,000
Oldest event available: 07/14/2016 20:56:52 UTC

Showing the most recent 1,000 of 1,000+ events, please refine the search.

	Date/Time	Type	FlowFile Uuid	Size	Component Name	Component Type	Node
	07/29/2016 00:14:...	ATTRIBUTES_MODI...	91ae19fa-5797-45...	1.11 KB	EvaluateJsonPath	EvaluateJsonPath	nifi-05.eng.hortonw...
	07/29/2016 00:14:...	ATTRIBUTES_MODI...	bcc29546-bbd0-43...	1.11 KB	EvaluateJsonPath	EvaluateJsonPath	nifi-05.eng.hortonw...
	07/29/2016 00:14:...	ATTRIBUTES_MODI...	9f4c3b69-6cef-40a...	1.11 KB	EvaluateJsonPath	[illegible]	nifi-05.eng.hortonw...
	07/2	TES_MODI...	38bb2021-1f07-4e...	1.11 KB	EvaluateJsonPath	[illegible]	nifi-05.eng.hortonw...
	[illegible]	TES_MODI...	f31d3aa0-40b7-46...	1.11 KB	EvaluateJsonPath	[illegible]	nifi-05.eng.hortonw...
	07/2	TES_MODI...	7d12c959-6952-41...	1.11 KB	EvaluateJsonPath	EvaluateJsonPath	nifi-05.eng.hortonw...
	07/29/2016 00:14:...	ATTRIBUTES_MODI...	93f31b5c-be89-49e...	1.11 KB	EvaluateJsonPath	EvaluateJsonPath	nifi-05.eng.hortonw...
	07/29/2016 00:14:...	ATTRIBUTES_MODI...	a1e5a6a4-b44e-4e...	1.11 KB	EvaluateJsonPath	[illegible]	nifi-05.eng.hortonw...
	07/29/2016 00:14:...	ATTRIBUTES_MODI...	cf2095c8-052a-47...	1.11 KB	EvaluateJsonPath	[illegible]	nifi-05.eng.hortonw...
	07/29/2016 00:14:...	ATTRIBUTES_MODI...	c0db8381-6c13-42...	1.11 KB	EvaluateJsonPath	[illegible]	nifi-05.eng.hortonw...
	07/29/2016 00:14:...	ATTRIBUTES_MODI...	9da3e06d-9715-46...	1.11 KB	EvaluateJsonPath	EvaluateJsonPath	nifi-05.eng.hortonw...
	07/29/2016 00:14:...	ATTRIBUTES_MODI...	18247e64-41b3-4f...	1.11 KB	EvaluateJsonPath	EvaluateJsonPath	nifi-05.eng.hortonw...

Last updated: 00:14:35 UTC

Provenance Events

Each point in a dataflow where a FlowFile is processed in some way is considered a 'provenance event'. Various types of provenance events occur, depending on the dataflow design. For example, when data is brought into the flow, a RECEIVE event occurs, and when data is sent out of the flow, a SEND event occurs. Other types of processing events may occur, such as if the data is cloned (CLONE event), routed (ROUTE event), modified (CONTENT_MODIFIED or ATTRIBUTES_MODIFIED event), split (FORK event), combined with other data objects (JOIN event), and ultimately removed from the flow (DROP event).

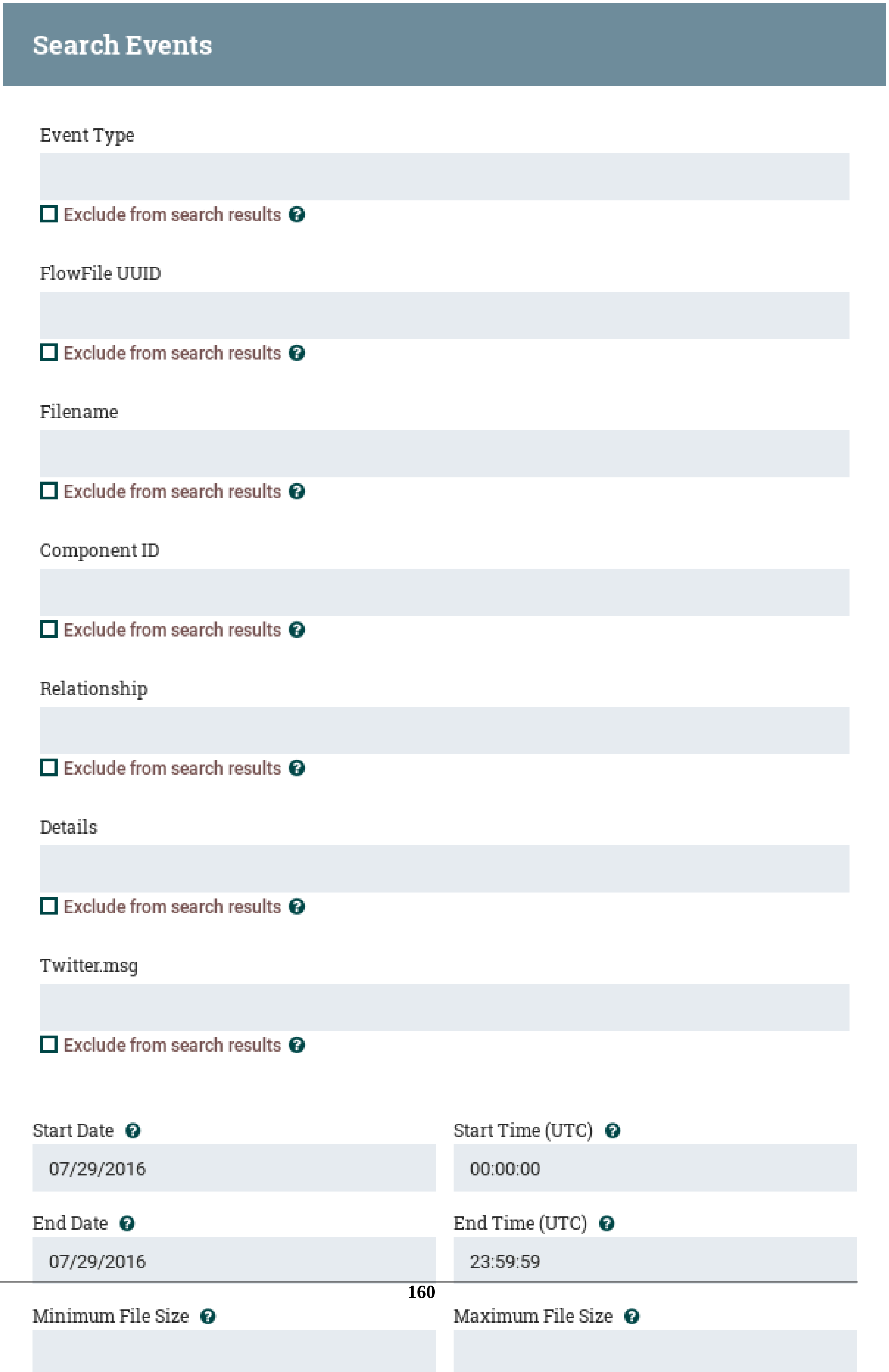
The provenance event types are:

Provenance Event	Description
ADDINFO	Indicates a provenance event when additional information such as a new linkage to a new URI or UUID is added
ATTRIBUTES_MODIFIED	Indicates that a FlowFile's attributes were modified in some way
CLONE	Indicates that a FlowFile is an exact duplicate of its parent FlowFile
CONTENT_MODIFIED	Indicates that a FlowFile's content was modified in some way
CREATE	Indicates that a FlowFile was generated from data that was not received from a remote system or external process
DOWNLOAD	Indicates that the contents of a FlowFile were downloaded by a user or external entity
DROP	Indicates a provenance event for the conclusion of an object's life for some reason other than object expiration

Provenance Event	Description
EXPIRE	Indicates a provenance event for the conclusion of an object's life due to the object not being processed in a timely manner
FETCH	Indicates that the contents of a FlowFile were overwritten using the contents of some external resource
FORK	Indicates that one or more FlowFiles were derived from a parent FlowFile
JOIN	Indicates that a single FlowFile is derived from joining together multiple parent FlowFiles
RECEIVE	Indicates a provenance event for receiving data from an external process
REMOTE_INVOCATION	Indicates that a remote invocation was requested to an external endpoint (e.g. deleting a remote resource)
REPLAY	Indicates a provenance event for replaying a FlowFile
ROUTE	Indicates that a FlowFile was routed to a specified relationship and provides information about why the FlowFile was routed to this relationship
SEND	Indicates a provenance event for sending data to an external process
UNKNOWN	Indicates that the type of provenance event is unknown because the user who is attempting to access the event is not authorized to know the type

Searching for Events

One of the most common tasks performed in the Data Provenance page is a search for a given FlowFile to determine what happened to it. To do this, click the "Search" button in the upper-right corner of the Data Provenance page. This opens a dialog window with parameters that the user can define for the search. The parameters include the processing event of interest, distinguishing characteristics about the FlowFile or the component that produced the event, the timeframe within which to search, and the size of the FlowFile.


Search Events

Event Type

☐ Exclude from search results

FlowFile UUID

☐ Exclude from search results

Filename

☐ Exclude from search results

Component ID

☐ Exclude from search results

Relationship

☐ Exclude from search results

Details

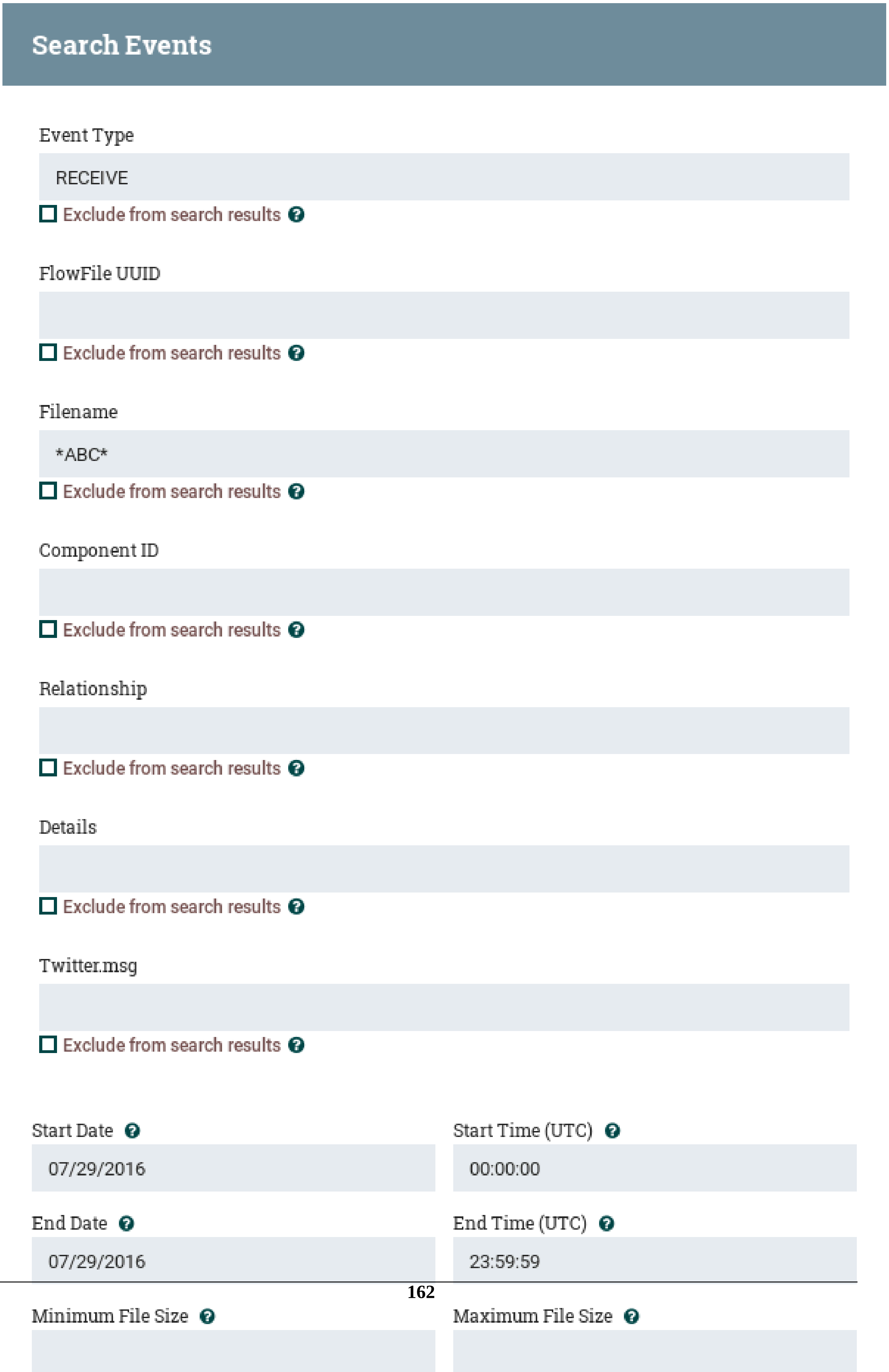
☐ Exclude from search results

Twitter.msg

☐ Exclude from search results

Start Date: 07/29/2016
Start Time (UTC): 00:00:00
End Date: 07/29/2016
End Time (UTC): 23:59:59
Minimum File Size
Maximum File Size

For example, to determine if a particular FlowFile was received, search for an Event Type of "RECEIVE" and include an identifier for the FlowFile, such as its uuid or filename. The asterisk (*) may be used as a wildcard for any number of characters. So, to determine whether a FlowFile with "ABC" anywhere in its filename was received at any time on July 29, 2016, the search shown in the following image could be performed:



Search Events

Event Type

RECEIVE

☐ Exclude from search results

FlowFile UUID

☐ Exclude from search results

Filename

ABC

☐ Exclude from search results

Component ID

☐ Exclude from search results

Relationship

☐ Exclude from search results

Details

☐ Exclude from search results

Twitter.msg

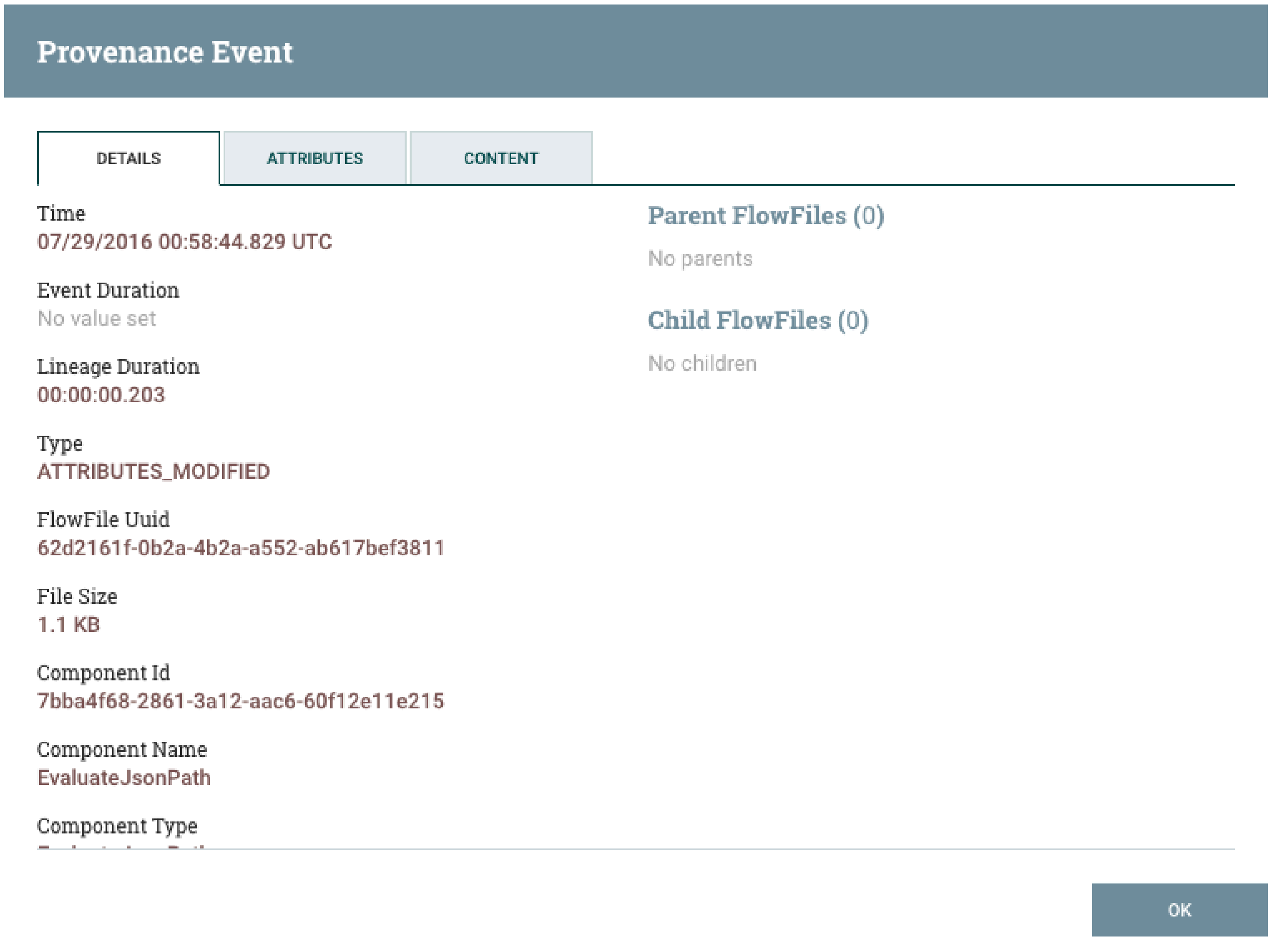
☐ Exclude from search results

Start Date: 07/29/2016	Start Time (UTC): 00:00:00
End Date: 07/29/2016	End Time (UTC): 23:59:59
Minimum File Size:	Maximum File Size:

If all filenames that do not have "ABC" anywhere in the filename is desired, then click the checkbox with the label "Exclude from search results" beneath this entry before performing the search.

Details of an Event

In the far-left column of the Data Provenance page, there is a "View Details" icon for each event (ℹ). Clicking this button opens a dialog window with three tabs: Details, Attributes, and Content.



Provenance Event

DETAILS | ATTRIBUTES | CONTENT

Time
07/29/2016 00:58:44.829 UTC

Event Duration
No value set

Lineage Duration
00:00:00.203

Type
ATTRIBUTES_MODIFIED

FlowFile Uuid
62d2161f-0b2a-4b2a-a552-ab617bef3811

File Size
1.1 KB

Component Id
7bba4f68-2861-3a12-aac6-60f12e11e215

Component Name
EvaluateJsonPath

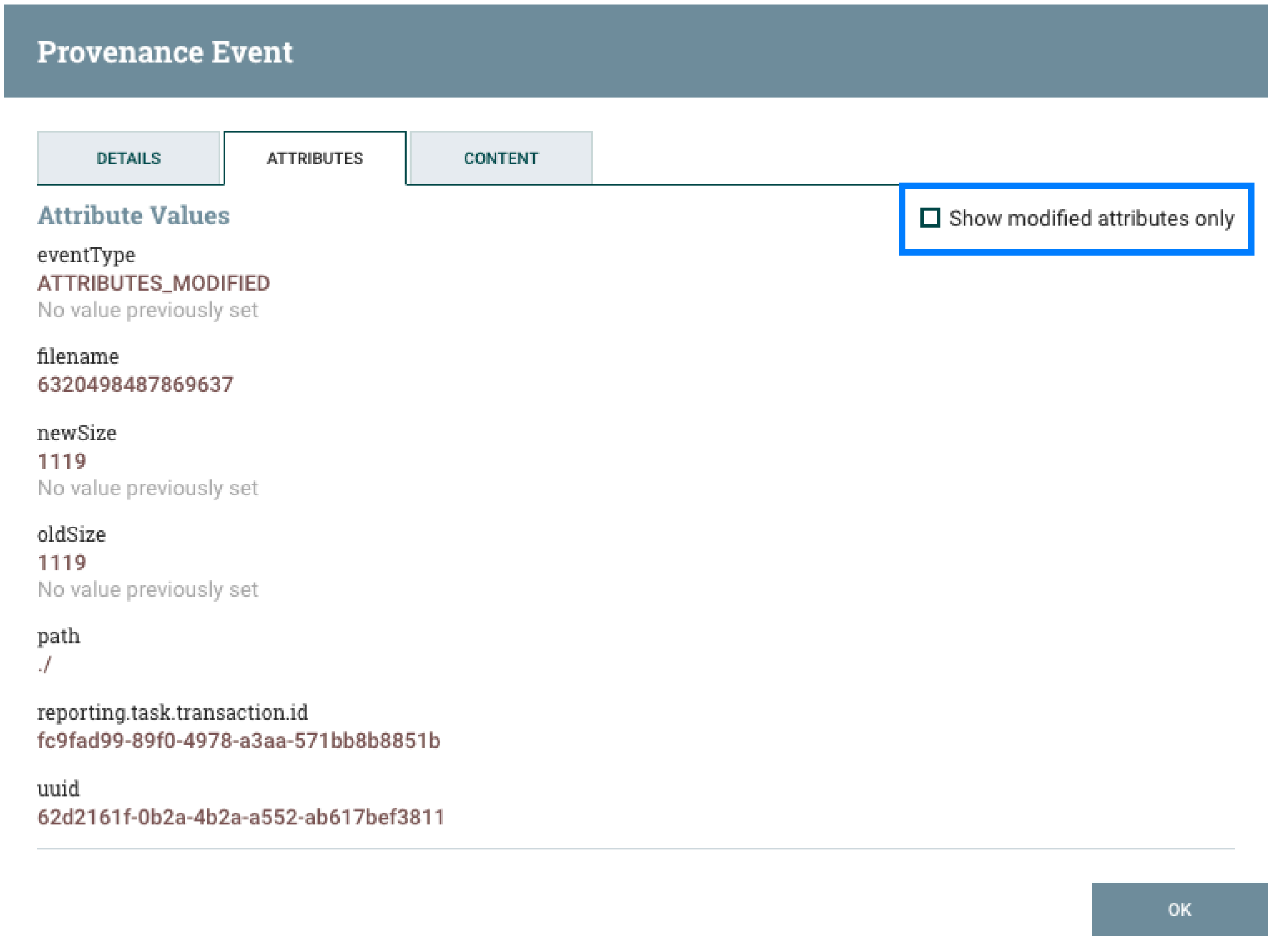
Component Type

Parent FlowFiles (0)
No parents

Child FlowFiles (0)
No children

The Details tab shows various details about the event, such as when it occurred, what type of event it was, and the component that produced the event. The information that is displayed will vary according to the event type. This tab also shows information about the FlowFile that was processed. In addition to the FlowFile's UUID, which is displayed on the left side of the Details tab, the UUIDs of any parent or children FlowFiles that are related to that FlowFile are displayed on the right side of the Details tab.

The Attributes tab shows the attributes that exist on the FlowFile as of that point in the flow. In order to see only the attributes that were modified as a result of the processing event, the user may select the checkbox next to "Only show modified" in the upper-right corner of the Attributes tab.



Attribute Values

eventType
ATTRIBUTES_MODIFIED
No value previously set

filename
6320498487869637

newSize
1119
No value previously set

oldSize
1119
No value previously set

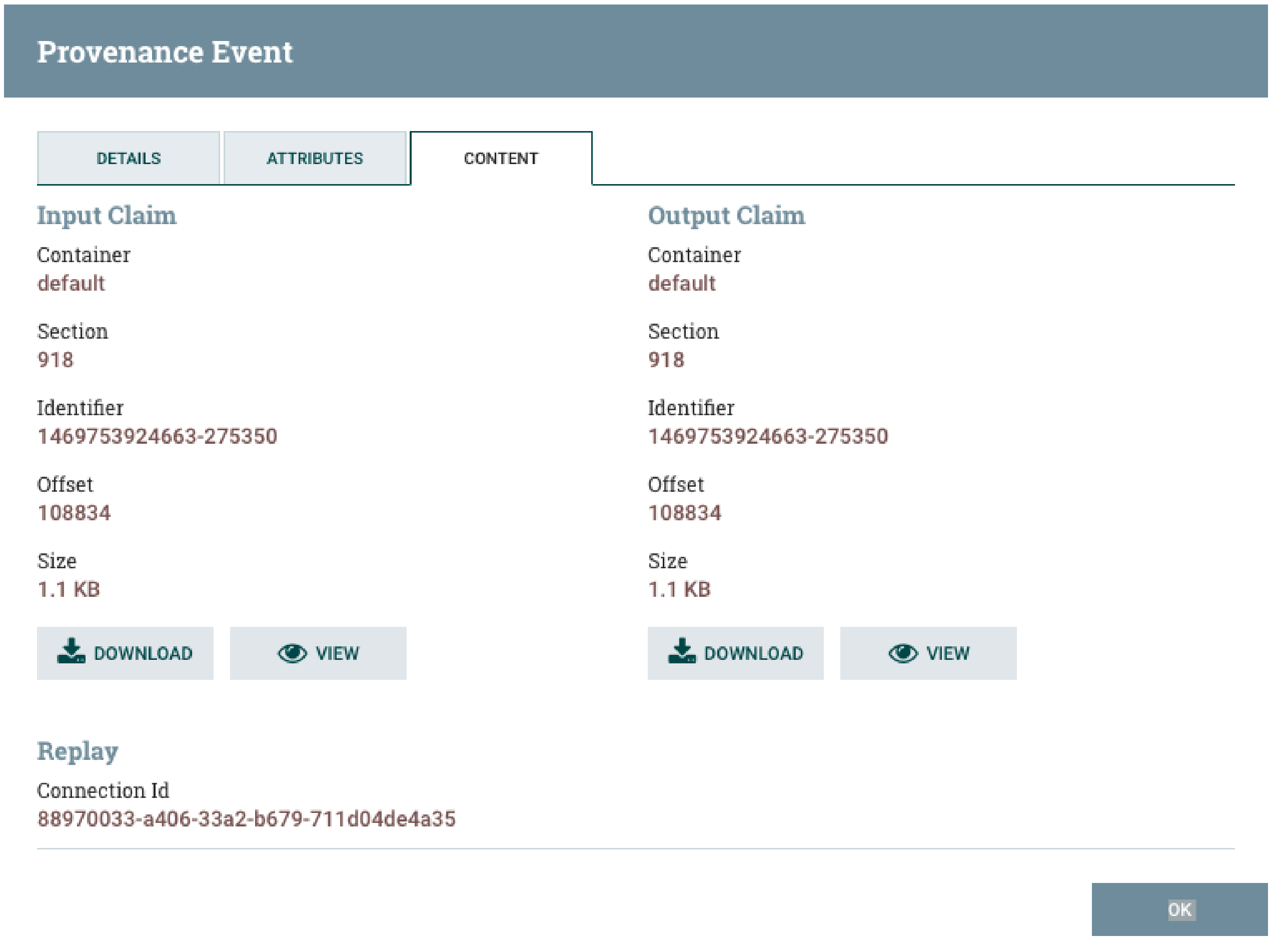
path
./

reporting.task.transaction.id
fc9fad99-89f0-4978-a3aa-571bb8b8851b

uuid
62d2161f-0b2a-4b2a-a552-ab617bef3811

Replaying a FlowFile

A DFM may need to inspect a FlowFile's content at some point in the dataflow to ensure that it is being processed as expected. And if it is not being processed properly, the DFM may need to make adjustments to the dataflow and replay the FlowFile again. The Content tab of the View Details dialog window is where the DFM can do these things. The Content tab shows information about the FlowFile's content, such as its location in the Content Repository and its size. In addition, it is here that the user may click the "Download" button to download a copy of the FlowFile's content as it existed at this point in the flow. The user may also click the "Submit" button to replay the FlowFile at this point in the flow. Upon clicking "Submit", the FlowFile is sent to the connection feeding the component that produced this processing event.


Provenance Event

Input Claim

Container
default

Section
918

Identifier
1469753924663-275350

Offset
108834

Size
1.1 KB

Output Claim

Container
default

Section
918

Identifier
1469753924663-275350

Offset
108834

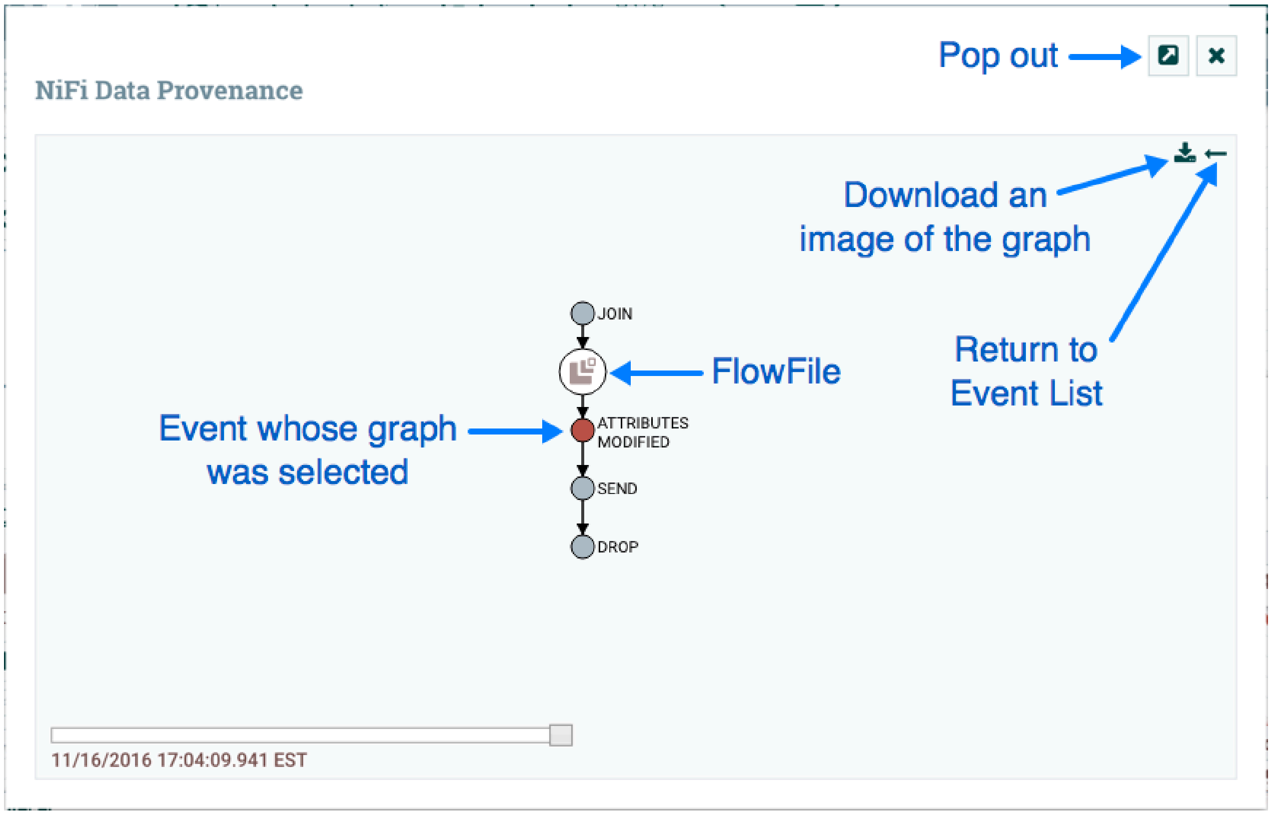
Size
1.1 KB

Replay

Connection Id
88970033-a406-33a2-b679-711d04de4a35

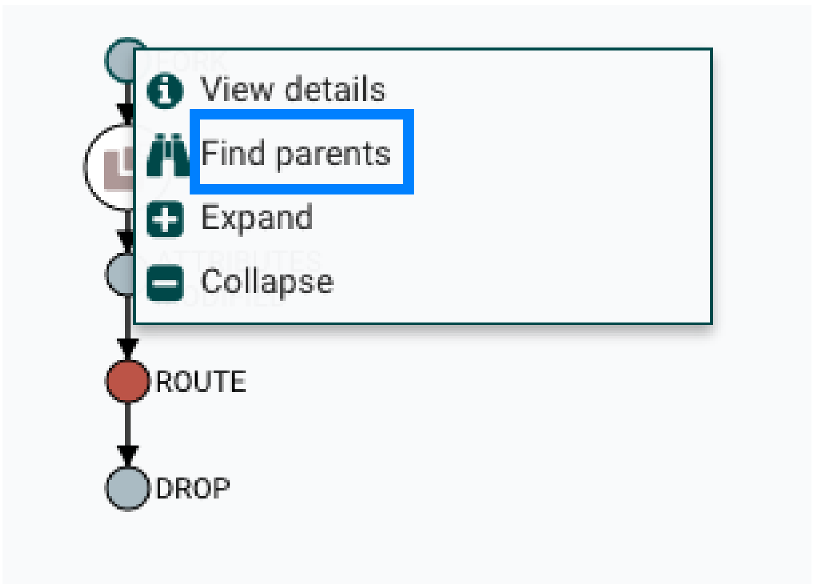
Viewing FlowFile Lineage

It is often useful to see a graphical representation of the lineage or path a FlowFile took within the dataflow. To see a FlowFile's lineage, click on the "Show Lineage" icon ( ) in the far-right column of the Data Provenance table. This opens a graph displaying the FlowFile ( ) and the various processing events that have occurred. The selected event will be highlighted in red. It is possible to right-click or double-click on any event to see that event's details (see Details of an Event). To see how the lineage evolved over time, click the slider at the bottom-left of the window and move it to the left to see the state of the lineage at earlier stages in the dataflow.

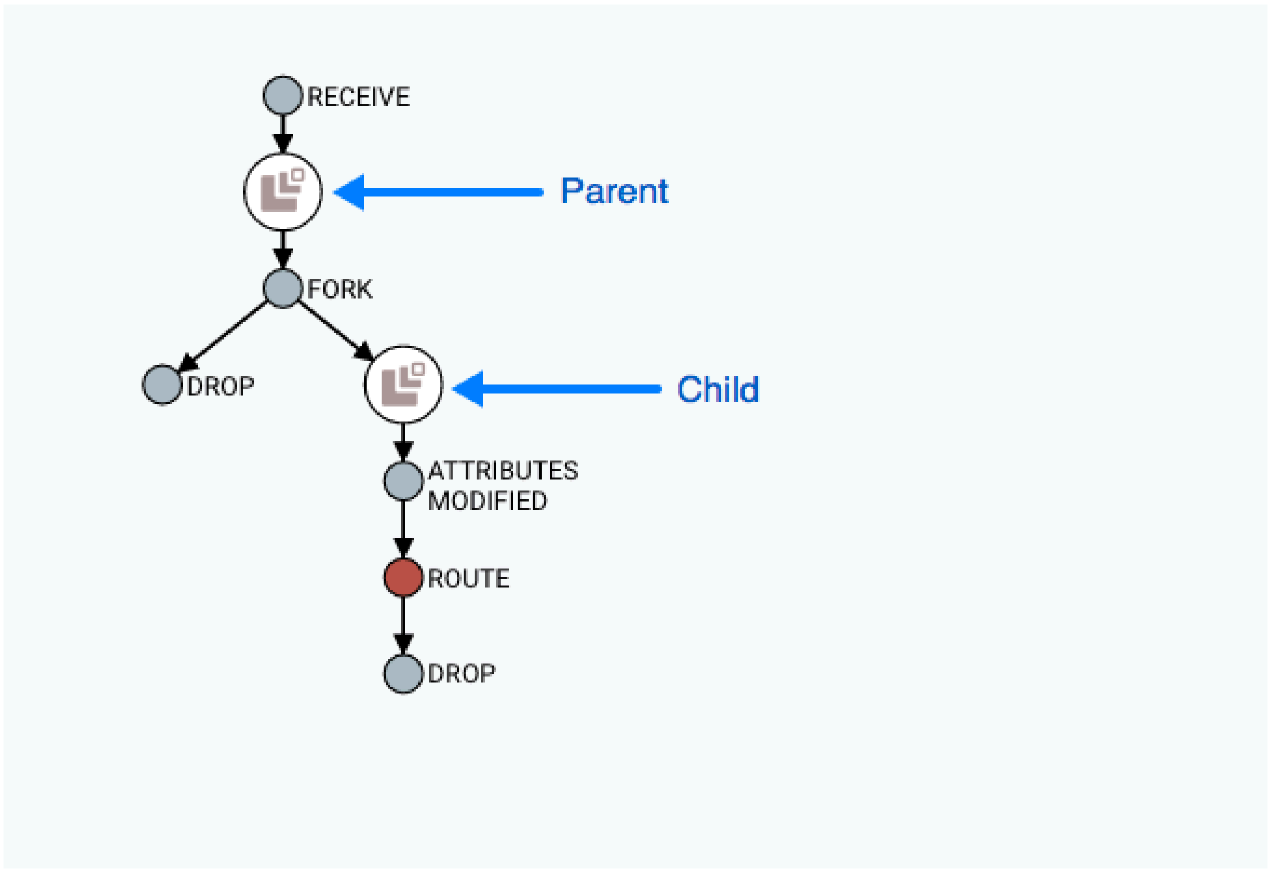

NiFi Data Provenance
Pop out
Download an image of the graph
Return to Event List
JOIN
FlowFile
Event whose graph was selected
ATTRIBUTES MODIFIED
SEND
DROP
11/16/2016 17:04:09.941 EST

Find Parents

Sometimes, a user may need to track down the original FlowFile that another FlowFile was spawned from. For example, when a FORK or CLONE event occurs, NiFi keeps track of the parent FlowFile that produced other FlowFiles, and it is possible to find that parent FlowFile in the Lineage. Right-click on the event in the lineage graph and select "Find parents" from the context menu.

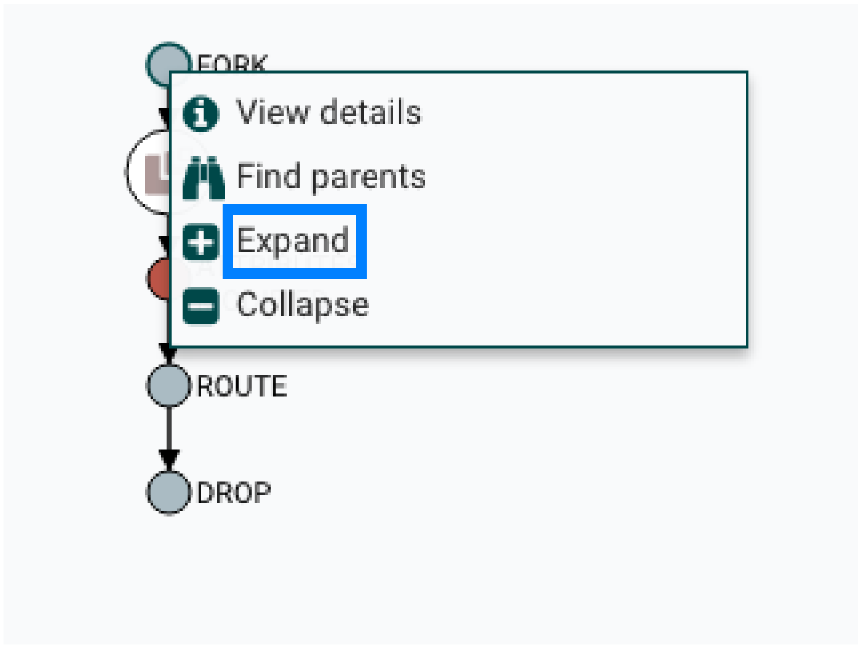


Once "Find parents" is selected, the graph is re-drawn to show the parent FlowFile and its lineage as well as the child and its lineage.

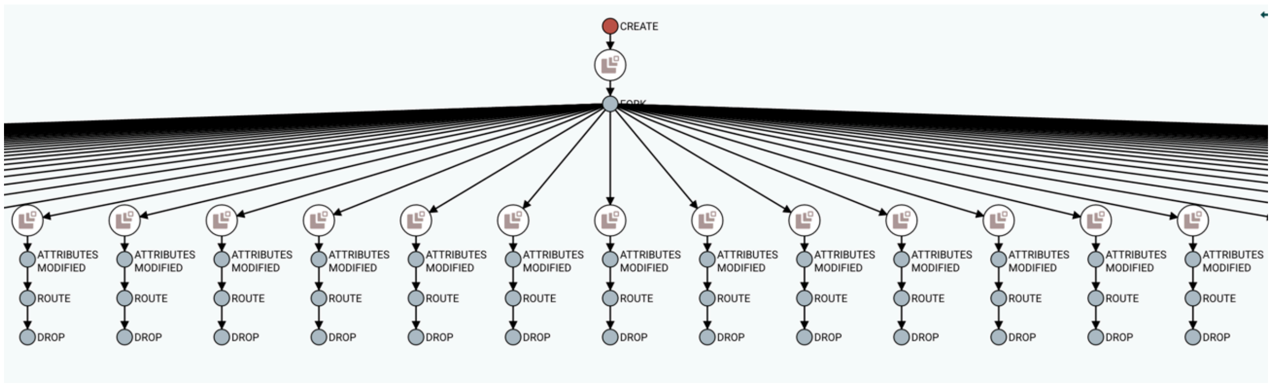


Expanding an Event

In the same way that it is useful to find a parent FlowFile, the user may also want to determine what children were spawned from a given FlowFile. To do this, right-click on the event in the lineage graph and select "Expand" from the context menu.



Once "Expand" is selected, the graph is re-drawn to show the children and their lineage.



Write Ahead Provenance Repository

By default, the Provenance Repository is implemented in a Persistent Provenance configuration. In Apache NiFi 1.2.0, the Write Ahead configuration was introduced to provide the same capabilities as Persistent Provenance, but with far better performance. Migrating to the Write Ahead configuration is easy to accomplish. Simply change the setting for the nifi.provenance.repository.implementation system property in the nifi.properties file from the default value of org.apache.nifi.provenance.PersistentProvenanceRepository to org.apache.nifi.provenance.WriteAheadPro venanceRepository and restart NiFi.

However, to increase the chances of a successful migration consider the following factors and recommended actions.

Backwards Compatibility

The WriteAheadProvenanceRepository can use the Provenance data stored by the PersistentProvenanceRepository. However, the PersistentProvenanceRepository may not be able to read the data written by the WriteAheadProven anceRepository. Therefore, once the Provenance Repository is changed to use the WriteAheadProvenanceReposito ry, it cannot be changed back to the PersistentProvenanceRepository without first deleting the data in the Provenance Repository. It is therefore recommended that before changing the implementation to Write Ahead, ensure your version of NiFi is stable, in case an issue arises that requires the need to roll back to a previous version of NiFi that did not support the WriteAheadProvenanceRepository.

Older Existing NiFi Version

If you are upgrading from an older version of NiFi to 1.2.0 or later, it is recommended that you do not change the provenance configuration to Write Ahead until you confirm your flows and environment are stable in 1.2.0 first. This reduces the number of variables in your upgrade and can simplify the debugging process if any issues arise.

Bootstrap.conf

While better performance is achieved with the G1 garbage collector, Java 8 bugs may surface more frequently in the Write Ahead configuration. It is recommended that the following line is commented out in the bootstrap.conf file in the conf directory:

```
java.arg.13=-XX:+UseG1GC
```

System Properties

Many of the same system properties are supported by both the Persistent and Write Ahead configurations, however the default values have been chosen for a Persistent Provenance configuration. The following exceptions and recommendations should be noted when changing to a Write Ahead configuration:

- nifi.provenance.repository.journal.count is not relevant to a Write Ahead configuration

- nifi.provenance.repository.concurrent.merge.threads and nifi.provenance.repository.warm.cache.frequency are new properties. The default values of 2 for threads and blank for frequency (i.e. disabled) should remain for most installations.
- Change the settings for nifi.provenance.repository.max.storage.time (default value of 24 hours) and nifi.provena nce.repository.max.storage.size (default value of 1 GB) to values more suitable for your production environment
- Change nifi.provenance.repository.index.shard.size from the default value of 500 MB to 4 GB
- Change nifi.provenance.repository.index.threads from the default value of 2 to either 4 or 8 as the Write Ahead repository enables this to scale better
- If processing a high volume of events, change nifi.provenance.repository.rollover.time from a default of 30 secs to 1 min and nifi.provenance.repository.rollover.size from the default of 100 MB to 1 GB

Once these property changes have been made, restart NiFi.

Note: Detailed descriptions for each of these properties can be found in System Properties.

Encrypted Provenance Considerations

The above migration recommendations for WriteAheadProvenanceRepository also apply to the encrypted version of the configuration, EncryptedWriteAheadProvenanceRepository.

The next section has more information about implementing an Encrypted Provenance Repository.

Encrypted Provenance Repository

While OS-level access control can offer some security over the provenance data written to the disk in a repository, there are scenarios where the data may be sensitive, compliance and regulatory requirements exist, or NiFi is running on hardware not under the direct control of the organization (cloud, etc.). In this case, the provenance repository allows for all data to be encrypted before being persisted to the disk.

Note: Experimental

This implementation is marked experimental as of Apache NiFi 1.10.0 (October 2019). The API, configuration, and internal behavior may change without warning, and such changes may occur during a minor release. Use at your own risk.

Note: Performance

The current implementation of the encrypted provenance repository intercepts the record writer and reader of WriteAheadProvenanceRepository, which offers significant performance improvements over the legacy PersistentProvenanceRepository and uses the AES/GCM algorithm, which is fairly performant on commodity hardware. In most scenarios, the added cost will not be significant (unnoticable on a flow with hundreds of provenance events per second, moderately noticable on a flow with thousands - tens of thousands of events per second). However, administrators should perform their own risk assessment and performance analysis and decide how to move forward. Switching back and forth between encrypted/unencrypted implementations is not recommended at this time.

What is it?

The EncryptedWriteAheadProvenanceRepository is a new implementation of the provenance repository which encrypts all event record information before it is written to the repository. This allows for storage on systems where OS-level access controls are not sufficient to protect the data while still allowing querying and access to the data through the NiFi UI/API.

How does it work?

The WriteAheadProvenanceRepository was introduced in NiFi 1.2.0 and provided a refactored and much faster provenance repository implementation than the previous PersistentProvenanceRepository. The encrypted version wraps that implementation with a record writer and reader which encrypt and decrypt the serialized bytes respectively.

The fully qualified class org.apache.nifi.provenance.EncryptedWriteAheadProvenanceRepository is specified as the provenance repository implementation in nifi.properties as the value of nifi.provenance.repository.implementation. In addition, new properties must be populated to allow successful initialization.

StaticKeyProvider

The StaticKeyProvider implementation defines keys directly in nifi.properties. Individual keys are provided in hexadecimal encoding. The keys can also be encrypted like any other sensitive property in nifi.properties using the ./ encrypt-config.sh tool in the NiFi Toolkit.

The following configuration section would result in a key provider with two available keys, "Key1" (active) and "AnotherKey".

```
nifi.provenance.repository.encryption.key.provider.implementation=org.apach
e.nifi.security.kms.StaticKeyProvider
nifi.provenance.repository.encryption.key.id=Key1
nifi.provenance.repository.encryption.key=0123456789ABCDEFFEDCBA987654321001
23456789ABCDEFFEDCBA9876543210
nifi.provenance.repository.encryption.key.id.AnotherKey=0101010101010101010
1010101010101010101010101010101010101010101
```

FileBasedKeyProvider

The FileBasedKeyProvider implementation reads from an encrypted definition file of the format:

```
key1=NGCpDpxBZNN0DBodz0p1SDbTjC2FG5kp1pCmdUKJlxxtcMSo6GC4fMlTyy1mPeKOxzLut3
DRX+51j6PCO5SznA==
key2=GYxPbMMDbnraXs09eGJudAM5jTvVYp05XtImkAg4JY4rIbmHOiVUUI6OeOf7ZW+hH42j
tPgNW9pSkkQ9HWY/vQ==
key3=SFe11xuz7J89Y/IQ7YbJPOL0/YKZRFL/VUxJgEHxxlXpd/8ELA7wwN59K1KTr3BURCcFP5
YGmwrSKfr4OE4Vlg==
key4=kZprfcTSTH69UuOU3jMkZfrtiVR/eqWmmbdku3bQcUJ/+UToecNB5lzOVEMBChyEXppy
XXC35Wa6GEXFK6PMKw==
key5=c6FzfnKm7UR7xqI2NFpZ+fEKBfSU7+1NvRw+XWQ9U39MONWqk5gvoyOCdFR1kUgeg46jrN
5dGXk13sRqE0GETQ==
```

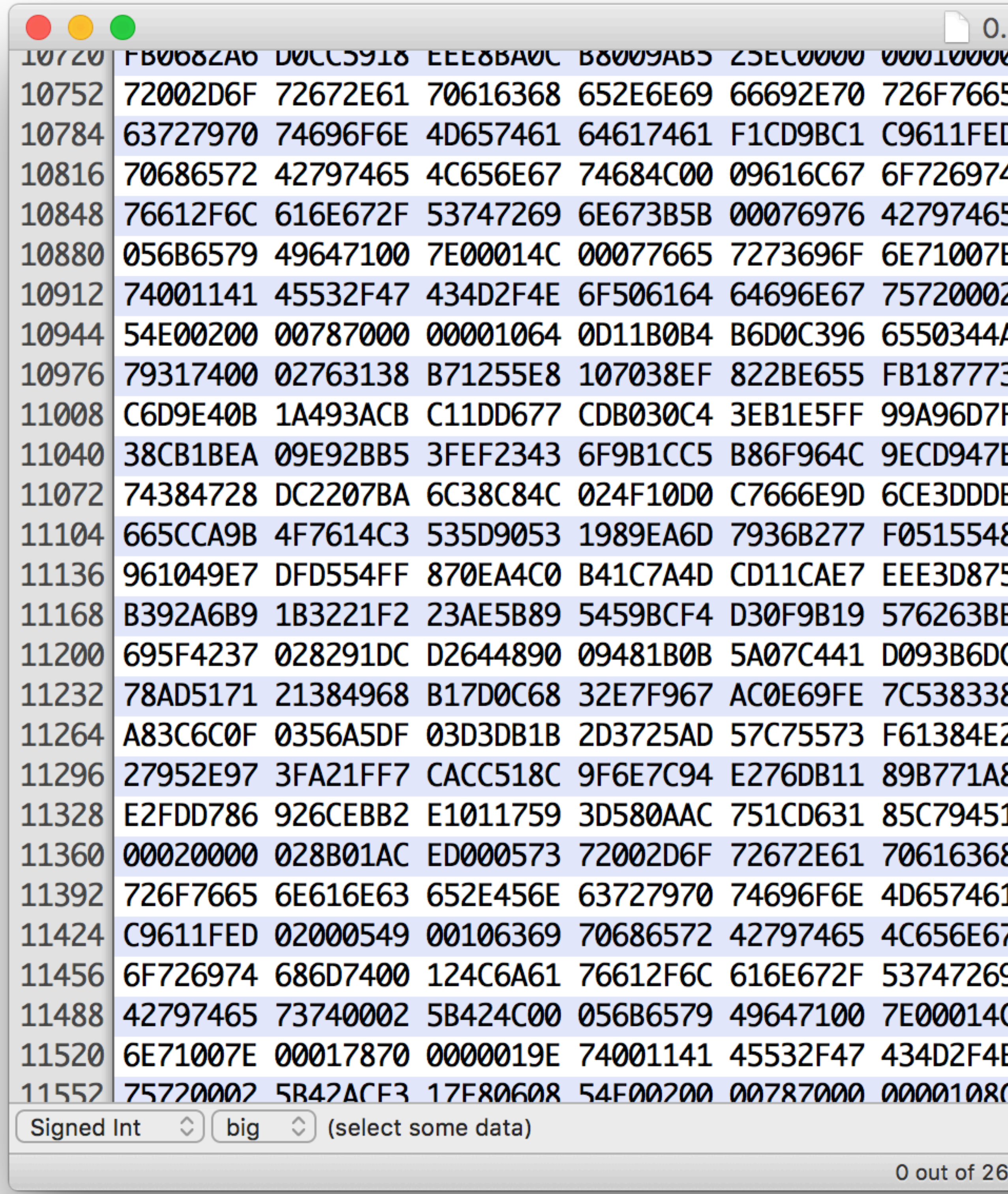
Each line defines a key ID and then the Base64-encoded cipher text of a 16 byte IV and wrapped AES-128, AES-192, or AES-256 key depending on the JCE policies available. The individual keys are wrapped by AES/GCM encryption using the root key defined by nifi.bootstrap.sensitive.key in conf/bootstrap.conf.

Key Rotation

Simply update nifi.properties to reference a new key ID in nifi.provenance.repository.encryption.key.id. Previously-encrypted events can still be decrypted as long as that key is still available in the key definition file or nifi.provena nce.repository.encryption.key.id.<OldKeyID> as the key ID is serialized alongside the encrypted record.

Writing and Reading Event Records

Once the repository is initialized, all provenance event record write operations are serialized according to the configured schema writer (EventIdFirstSchemaRecordWriter by default for WriteAheadProvenanceRepository) to a byte[]. Those bytes are then encrypted using an implementation of ProvenanceEventEncryptor (the only current implementation is AES/GCM/NoPadding) and the encryption metadata (keyId, algorithm, version, IV) is serialized and prepended. The complete byte[] is then written to the repository on disk as normal.



```
10720 FB0682A6 D0CC5918 EEE8BA0C B8009AB5 25EC0000 00010000
10752 72002D6F 72672E61 70616368 652E6E69 66692E70 726F7665
10784 63727970 74696F6E 4D657461 64617461 F1CD9BC1 C9611FE
10816 70686572 42797465 4C656E67 74684C00 09616C67 6F72697
10848 76612F6C 616E672F 53747269 6E673B5B 00076976 4279746
10880 056B6579 49647100 7E00014C 00077665 7273696F 6E71007
10912 74001141 45532F47 434D2F4E 6F506164 64696E67 7572000
10944 54E00200 00787000 00001064 0D11B0B4 B6D0C396 6550344
10976 79317400 02763138 B71255E8 107038EF 822BE655 FB18777
11008 C6D9E40B 1A493ACB C11DD677 CDB030C4 3EB1E5FF 99A96D7
11040 38CB1BEA 09E92BB5 3FEF2343 6F9B1CC5 B86F964C 9ECD947
11072 74384728 DC2207BA 6C38C84C 024F10D0 C7666E9D 6CE3DDD
11104 665CCA9B 4F7614C3 535D9053 1989EA6D 7936B277 F051554
11136 961049E7 DFD554FF 870EA4C0 B41C7A4D CD11CAE7 EEE3D87
11168 B392A6B9 1B3221F2 23AE5B89 5459BCF4 D30F9B19 576263B
11200 695F4237 028291DC D2644890 09481B0B 5A07C441 D093B6D
11232 78AD5171 21384968 B17D0C68 32E7F967 AC0E69FE 7C53833
11264 A83C6C0F 0356A5DF 03D3DB1B 2D3725AD 57C75573 F61384E
11296 27952E97 3FA21FF7 CACC518C 9F6E7C94 E276DB11 89B771A
11328 E2FDD786 926CEBB2 E1011759 3D580AAC 751CD631 85C7945
11360 00020000 028B01AC ED000573 72002D6F 72672E61 7061636
11392 726F7665 6E616E63 652E456E 63727970 74696F6E 4D65746
11424 C9611FED 02000549 00106369 70686572 42797465 4C656E6
11456 6F726974 686D7400 124C6A61 76612F6C 616E672F 5374726
11488 42797465 73740002 5B424C00 056B6579 49647100 7E00014
11520 6E71007E 00017870 0000019E 74001141 45532F47 434D2F4
11552 75720002 5B42ACF3 17F80608 54E00200 00787000 0000108
```

Signed Int | big | (select some data)

0 out of 26

On record read, the process is reversed. The encryption metadata is parsed and used to decrypt the serialized bytes, which are then deserialized into a ProvenanceEventRecord object. The delegation to the normal schema record writer/ reader allows for "random-access" (i.e. immediate seek without decryption of unnecessary records).

Within the NiFi UI/API, there is no detectable difference between an encrypted and unencrypted provenance repository. The Provenance Query operations work as expected with no change to the process.

Potential Issues

Note: Switching Implementations

When switching between implementation "families" (i.e. VolatileProvenanceRepository or PersistentProvenanceRepository to EncryptedWriteAheadProvenanceRepository), the existing repository must be cleared from the file system before starting NiFi. A terminal command like localhost:$NIFI_HOME $ rm -rf provenance_repository/ is sufficient.

- Switching between unencrypted and encrypted repositories
  - If a user has an existing repository (WriteAheadProvenanceRepository only - not PersistentProvenanceRepository) that is not encrypted and switches their configuration to use an encrypted repository, the application writes an error to the log but starts up. However, previous events are not accessible through the provenance query interface and new events will overwrite the existing events. The same behavior occurs if a user switches from an encrypted repository to an unencrypted repository. Automatic roll-over is a future effort (NIFI-3722) but NiFi is not intended for long-term storage of provenance events so the impact should be minimal. There are two scenarios for roll-over:
    - Encrypted # unencrypted - if the previous repository implementation was encrypted, these events should be handled seamlessly as long as the key provider available still has the keys used to encrypt the events (see Key Rotation)
    - Unencrypted # encrypted - if the previous repository implementation was unencrypted, these events should be handled seamlessly as the previously recorded events simply need to be read with a plaintext schema record reader and then written back with the encrypted record writer
  - There is also a future effort to provide a standalone tool in NiFi Toolkit to encrypt/decrypt an existing provenance repository to make the transition easier. The translation process could take a long time depending on the size of the existing repository, and being able to perform this task outside of application startup would be valuable (NIFI-3723).
- Multiple repositories - No additional effort or testing has been applied to multiple repositories at this time. It is possible/likely issues will occur with repositories on different physical devices. There is no option to provide a heterogenous environment (i.e. one encrypted, one plaintext repository).
- Corruption - when a disk is filled or corrupted, there have been reported issues with the repository becoming corrupted and recovery steps are necessary. This is likely to continue to be an issue with the encrypted repository, although still limited in scope to individual records (i.e. an entire repository file won't be irrecoverable due to the encryption).

Encrypted Content Repository

While OS-level access control can offer some security over the flowfile content data written to the disk in a repository, there are scenarios where the data may be sensitive, compliance and regulatory requirements exist, or NiFi is running on hardware not under the direct control of the organization (cloud, etc.). In this case, the content repository allows for all data to be encrypted before being persisted to the disk. For more information on the internal workings of the content repository, see NiFi In-Depth - Content Repository.

Note: Experimental

This implementation is marked experimental as of Apache NiFi 1.10.0 (October 2019). The API, configuration, and internal behavior may change without warning, and such changes may occur during a minor release. Use at your own risk.

Note: Performance

The current implementation of the encrypted content repository intercepts the serialization of content data via the EncryptedContentRepositoryOutputStream and uses the AES/CTR algorithm, which is fairly performant on commodity hardware. This use of a stream cipher (because the content is operated on in a streaming manner for performance) differs from the use of an authenticated encryption algorithm (AEAD) like AES/GCM in the Encrypted Provenance Repository. In most scenarios, the added cost will not be significant (unnoticable on a flow with hundreds of content read/write events per second, moderately noticable on a flow with thousands - tens of thousands of events per second). However, administrators should perform their own risk assessment and performance analysis and decide how to move forward. Switching back and forth between encrypted/unencrypted implementations is not recommended at this time.

What is it?

The EncryptedFileSystemRepository is a new implementation of the content repository which encrypts all content data before it is written to the repository. This allows for storage on systems where OS-level access controls are not sufficient to protect the data while still allowing querying and access to the data through the NiFi UI/API.

How does it work?

The FileSystemRepository was introduced in NiFi 0.2.1 and provided the only persistent content repository implementation. The encrypted version wraps that implementation with functionality to return to the Session (usually StandardProcessSession) a special OutputStream/InputStream which encrypt and decrypt the serialized bytes respectively. This allows all components to continue interacting with the content repository interface in the same way as before and continue operating on content data in a streaming manner, without requiring any changes to handle the data protection.

The fully qualified class org.apache.nifi.content.EncryptedFileSystemRepository is specified as the content repository implementation in nifi.properties as the value of nifi.content.repository.implementation. In addition, new properties must be populated to allow successful initialization.

StaticKeyProvider

The StaticKeyProvider implementation defines keys directly in nifi.properties. Individual keys are provided in hexadecimal encoding. The keys can also be encrypted like any other sensitive property in nifi.properties using the ./encrypt-config.sh tool in the NiFi Toolkit.

The following configuration section would result in a key provider with two available keys, "Key1" (active) and "AnotherKey".

```
nifi.content.repository.encryption.key.provider.implementation=org.apache.n
ifi.security.kms.StaticKeyProvider
nifi.content.repository.encryption.key.id=Key1
nifi.content.repository.encryption.key=0123456789ABCDEFFEDCBA9876543210012
3456789ABCDEFFEDCBA9876543210
nifi.content.repository.encryption.key.id.AnotherKey=01010101010101010101010
10101010101010101010101010101010101010101
```

FileBasedKeyProvider

The FileBasedKeyProvider implementation reads from an encrypted definition file of the format:

```
key1=NGCpDpxBZNN0DBodz0p1SDbTjC2FG5kp1pCmdUKJlxxtcMSo6GC4fMlTyy1mPeKOxzLut3
DRX+51j6PCO5SznA==
key2=GYxPbMMDbnraXs09eGJudAM5jTvVYp05XtImkAg4JY4rIbmHOiVUUI6OeOf7ZW+hH42j
tPgNW9pSkkQ9HWY/vQ==
key3=SFe11xuz7J89Y/IQ7YbJPOL0/YKZRFL/VUxJgEHxxlXpd/8ELA7wwN59K1KTr3BURCcFP5
YGmwrSKfr4OE4Vlg==
key4=kZprfcTSTH69UuOU3jMkZfrtiVR/eqWmmbdku3bQcUJ/+UToecNB5lzOVEMBChyEXppy
XXC35Wa6GEXFK6PMKw==
key5=c6FzfnKm7UR7xqI2NFpZ+fEKBfSU7+1NvRw+XWQ9U39MONWqk5gvoyOCdFR1kUgeg46jrN
5dGXk13sRqE0GETQ==
```

Each line defines a key ID and then the Base64-encoded cipher text of a 16 byte IV and wrapped AES-128, AES-192, or AES-256 key depending on the JCE policies available. The individual keys are wrapped by AES/GCM encryption using the root key defined by nifi.bootstrap.sensitive.key in conf/bootstrap.conf.

Data Protection vs. Key Protection

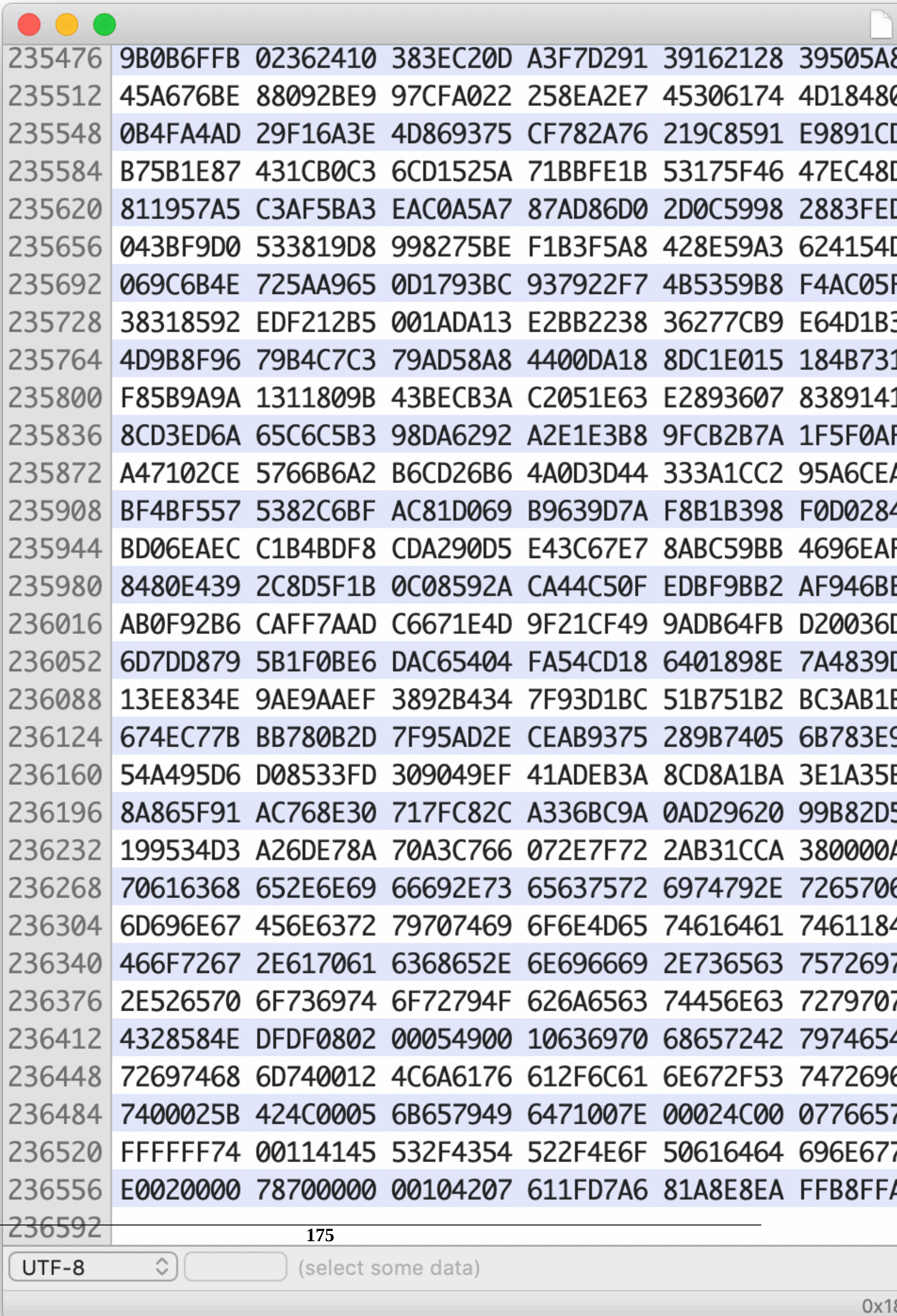
Even though the flowfile content is encrypted using AES/CTR to handle streaming data, if using the Config Encrypt Tool or FileBasedKeyProvider, those keys will be protected using AES/GCM to provide authenticated encryption over the key material.

Key Rotation

Simply update nifi.properties to reference a new key ID in nifi.content.repository.encryption.key.id. Previously-encrypted content claims can still be decrypted as long as that key is still available in the key definition file or nifi.content.repository.encryption.key.id.<OldKeyID> as the key ID is serialized alongside the encrypted content.

Writing and Reading Content Claims

Once the repository is initialized, all content claim write operations are serialized using RepositoryObjectStreamEncryptor (the only currently existing implementation is RepositoryObjectAESCTREncryptor) to an OutputStream. The actual implementation is EncryptedContentRepositoryOutputStream, which encrypts the data written by the component via StandardProcessSession inline and the encryption metadata (keyId, algorithm, version, IV) is serialized and prepended. The complete OutputStream is then written to the repository on disk as normal.



```
235476 9B0B6FFB 02362410 383EC20D A3F7D291 39162128 39505A8
235512 45A676BE 88092BE9 97CFA022 258EA2E7 45306174 4D1848
235548 0B4FA4AD 29F16A3E 4D869375 CF782A76 219C8591 E9891C
235584 B75B1E87 431CB0C3 6CD1525A 71BBFE1B 53175F46 47EC48
235620 811957A5 C3AF5BA3 EAC0A5A7 87AD86D0 2D0C5998 2883FE
235656 043BF9D0 533819D8 998275BE F1B3F5A8 428E59A3 624154
235692 069C6B4E 725AA965 0D1793BC 937922F7 4B5359B8 F4AC05
235728 38318592 EDF212B5 001ADA13 E2BB2238 36277CB9 E64D1B
235764 4D9B8F96 79B4C7C3 79AD58A8 4400DA18 8DC1E015 184B731
235800 F85B9A9A 1311809B 43BECB3A C2051E63 E2893607 8389141
235836 8CD3ED6A 65C6C5B3 98DA6292 A2E1E3B8 9FCB2B7A 1F5F0A
235872 A47102CE 5766B6A2 B6CD26B6 4A0D3D44 333A1CC2 95A6CE
235908 BF4BF557 5382C6BF AC81D069 B9639D7A F8B1B398 F0D028
235944 BD06EAEC C1B4BDF8 CDA290D5 E43C67E7 8ABC59BB 4696EA
235980 8480E439 2C8D5F1B 0C08592A CA44C50F EDBF9BB2 AF946B
236016 AB0F92B6 CAFF7AAD C6671E4D 9F21CF49 9ADB64FB D20036
236052 6D7DD879 5B1F0BE6 DAC65404 FA54CD18 6401898E 7A4839
236088 13EE834E 9AE9AAEF 3892B434 7F93D1BC 51B751B2 BC3AB1
236124 674EC77B BB780B2D 7F95AD2E CEAB9375 289B7405 6B783E
236160 54A495D6 D08533FD 309049EF 41ADEB3A 8CD8A1BA 3E1A35
236196 8A865F91 AC768E30 717FC82C A336BC9A 0AD29620 99B82D
236232 199534D3 A26DE78A 70A3C766 072E7F72 2AB31CCA 380000
236268 70616368 652E6E69 66692E73 65637572 6974792E 726570
236304 6D696E67 456E6372 79707469 6F6E4D65 74616461 746118
236340 466F7267 2E617061 6368652E 6E696669 2E736563 757269
236376 2E526570 6F736974 6F72794F 626A6563 74456E63 727970
236412 4328584E DFDF0802 00054900 10636970 68657242 797465
236448 72697468 6D740012 4C6A6176 612F6C61 6E672F53 747269
236484 7400025B 424C0005 6B657949 6471007E 00024C00 077665
236520 FFFFFF74 00114145 532F4354 522F4E6F 50616464 696E67
236556 E0020000 78700000 00104207 611FD7A6 81A8E8EA FFB8FF
236592
```

On content claim read, the process is reversed. The encryption metadata (RepositoryObjectEncryptionMetadata) is parsed and used to decrypt the serialized bytes, which are then deserialized into a CipherInputStream object. The delegation to the normal repository file system interaction allows for "random-access" (i.e. immediate seek without decryption of unnecessary content claims).

Within the NiFi UI/API, there is no detectable difference between an encrypted and unencrypted content repository. The Provenance Query operations to view content work as expected with no change to the process.

Potential Issues

Note: Switching Implementations

When switching between implementation "families" (i.e. VolatileContentRepository or FileSystemReposi tory to EncryptedFileSystemRepository), the existing repository must be cleared from the file system before starting NiFi. A terminal command like localhost:$NIFI_HOME $ rm -rf content_repository/ is sufficient.

- Switching between unencrypted and encrypted repositories
  - If a user has an existing repository (FileSystemRepository) that is not encrypted and switches their configuration to use an encrypted repository, the application writes an error to the log but starts up. However, previous content claims are not accessible through the provenance query interface and new content claims will overwrite the existing claims. The same behavior occurs if a user switches from an encrypted repository to an unencrypted repository. Automatic roll-over is a future effort (NIFI-6783) but NiFi is not intended for long-term storage of content claims so the impact should be minimal. There are two scenarios for roll-over:
    - Encrypted # unencrypted - if the previous repository implementation was encrypted, these claims should be handled seamlessly as long as the key provider available still has the keys used to encrypt the claims (see Key Rotation)
    - Unencrypted # encrypted - if the previous repository implementation was unencrypted, these claims should be handled seamlessly as the previously written claims simply need to be read with a plaintext InputStream and then be written back with the EncryptedContentRepositoryOutputStream
  - There is also a future effort to provide a standalone tool in NiFi Toolkit to encrypt/decrypt an existing content repository to make the transition easier. The translation process could take a long time depending on the size of the existing repository, and being able to perform this task outside of application startup would be valuable (NIFI-6783).
- Multiple repositories - No additional effort or testing has been applied to multiple repositories at this time. It is possible/likely issues will occur with repositories on different physical devices. There is no option to provide a heterogenous environment (i.e. one encrypted, one plaintext repository).
- Corruption - when a disk is filled or corrupted, there have been reported issues with the repository becoming corrupted and recovery steps are necessary. This is likely to continue to be an issue with the encrypted repository, although still limited in scope to individual claims (i.e. an entire repository file won't be irrecoverable due to the encryption). Some testing has been performed on scenarios where disk space is exhausted. While the flow can no longer write additional content claims to the repository in that case, the NiFi application continues to function properly, and successfully written content claims are still available via the Provenance Query operations. Stopping NiFi and removing the content repository (or moving it to a larger disk) resolves the issue.

Encrypted FlowFile Repository

While OS-level access control can offer some security over the flowfile attribute and content claim data written to the disk in a repository, there are scenarios where the data may be sensitive, compliance and regulatory requirements exist, or NiFi is running on hardware not under the direct control of the organization (cloud, etc.). In this case, the flowfile repository allows for all data to be encrypted before being persisted to the disk. For more information on the internal workings of the flowfile repository, see NiFi In-Depth - FlowFile Repository.

Note: Experimental

This implementation is marked experimental as of Apache NiFi 1.11.0 (January 2020). The API, configuration, and internal behavior may change without warning, and such changes may occur during a minor release. Use at your own risk.

Note: Performance

The current implementation of the encrypted flowfile repository intercepts the serialization of flowfile record data via the EncryptedSchemaRepositoryRecordSerde and uses the AES/GCM algorithm, which is fairly performant on commodity hardware. This use of an authenticated encryption algorithm (AEAD) block cipher (because the content length is limited and known a priori) is the same as the Encrypted Provenance Repository, but differs from the unauthenticated stream cipher used in the Encrypted Content Repository. In low volume flowfile scenarios, the added cost will be minimal. However, administrators should perform their own risk assessment and performance analysis and decide how to move forward. Switching back and forth between encrypted/unencrypted implementations is not recommended at this time.

What is it?

The EncryptedSequentialAccessWriteAheadLog is a new implementation of the flowfile write-ahead log which encrypts all flowfile attribute data before it is written to the repository. This allows for storage on systems where OS-level access controls are not sufficient to protect the data while still allowing querying and access to the data through the NiFi UI/API.

How does it work?

The SequentialAccessWriteAheadLog was introduced in NiFi 1.6.0 and provided a faster flowfile repository implementation. The encrypted version wraps that implementation with functionality to transparently encrypt and decrypt the serialized RepositoryRecord objects during file system interaction. During all writes to disk (swapping, snapshotting, journaling, and checkpointing), the flowfile containers are serialized to bytes based on a schema, and this serialized form is encrypted before writing. This allows the snapshot handler to continue interacting with the flowfile repository interface in the same way as before and continue operating on flowfile data in a random access manner, without requiring any changes to handle the data protection.

The fully qualified class org.apache.nifi.wali.EncryptedSequentialAccessWriteAheadLog is specified as the flowfile repository write-ahead log implementation in nifi.properties as the value of nifi.flowfile.repository.wal.implementation. In addition, new properties must be populated to allow successful initialization.

StaticKeyProvider

The StaticKeyProvider implementation defines keys directly in nifi.properties. Individual keys are provided in hexadecimal encoding. The keys can also be encrypted like any other sensitive property in nifi.properties using the ./encrypt-config.sh tool in the NiFi Toolkit.

The following configuration section would result in a key provider with two available keys, "Key1" (active) and "AnotherKey".

```
nifi.flowfile.repository.encryption.key.provider.implementation=org.apache.
nifi.security.kms.StaticKeyProvider
nifi.flowfile.repository.encryption.key.id=Key1
nifi.flowfile.repository.encryption.key=0123456789ABCDEFFEDCBA98765432100123
456789ABCDEFFEDCBA9876543210
nifi.flowfile.repository.encryption.key.id.AnotherKey=0101010101010101010
1010101010101010101010101010101010101
```

FileBasedKeyProvider

The FileBasedKeyProvider implementation reads from an encrypted definition file of the format:

```
key1=NGCpDpxBZNN0DBodz0p1SDbTjC2FG5kp1pCmdUKJlxxtcMSo6GC4fMlTyy1mPeKOxzLut3
DRX+51j6PCO5SznA==
key2=GYxPbMMDbnraXs09eGJudAM5jTvVYp05XtImkAg4JY4rIbmHOiVUUI6OeOf7ZW+hH42j
tPgNW9pSkkQ9HWY/vQ==
key3=SFe11xuz7J89Y/IQ7YbJPOL0/YKZRFL/VUxJgEHxxlXpd/8ELA7wwN59K1KTr3BURCcFP5
YGmwrSKfr4OE4Vlg==
key4=kZprfcTSTH69UuOU3jMkZfrtiVR/eqWmmbdku3bQcUJ/+UToecNB5lzOVEMBChyEXppy
XXC35Wa6GEXFK6PMKw==
key5=c6FzfnKm7UR7xqI2NFpZ+fEKBfSU7+1NvRw+XWQ9U39MONWqk5gvoyOCdFR1kUgeg46jrN
5dGXk13sRqE0GETQ==
```

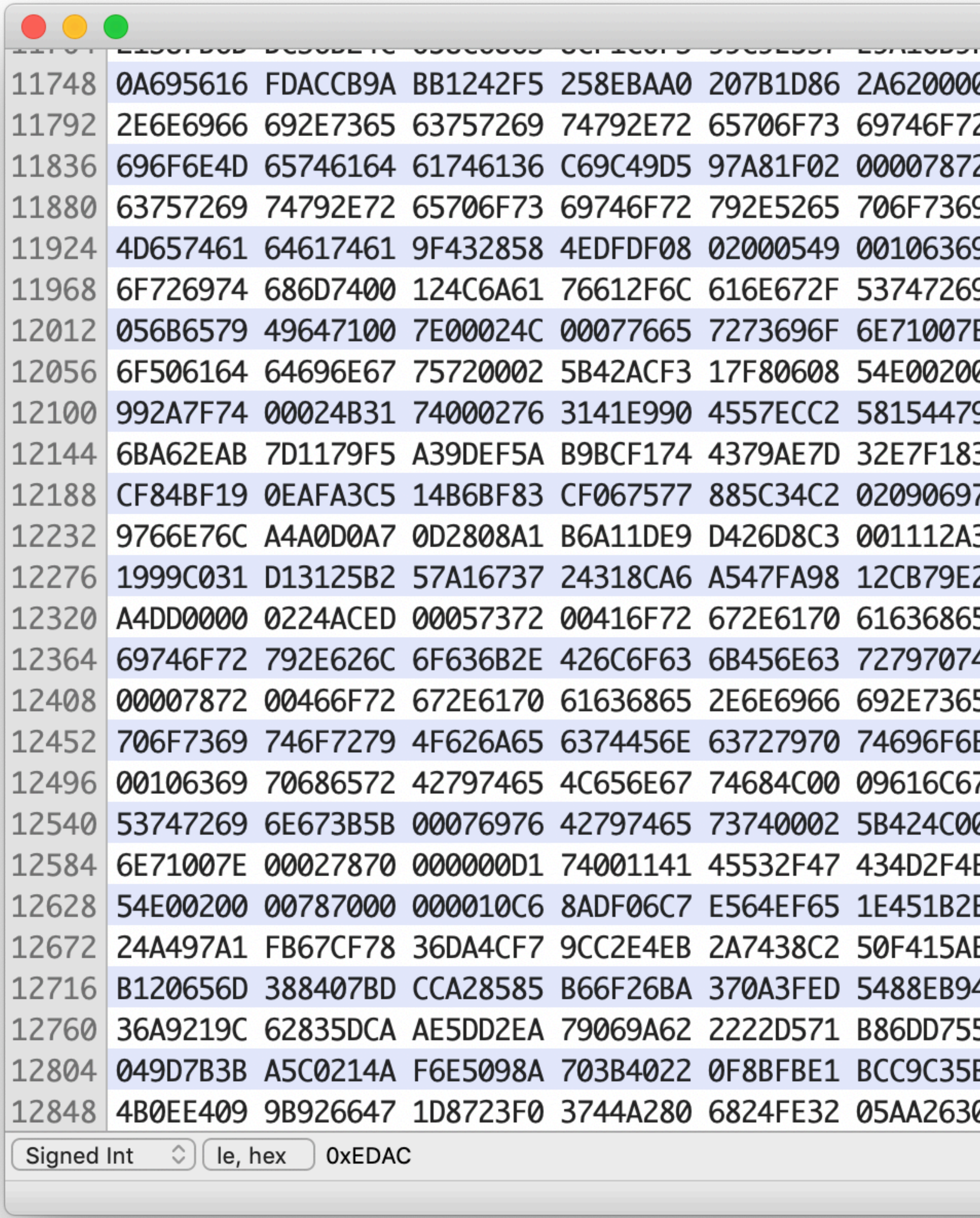
Each line defines a key ID and then the Base64-encoded cipher text of a 16 byte IV and wrapped AES-128, AES-192, or AES-256 key depending on the JCE policies available. The individual keys are wrapped by AES/GCM encryption using the root key defined by nifi.bootstrap.sensitive.key in conf/bootstrap.conf.

Key Rotation

Simply update nifi.properties to reference a new key ID in nifi.flowfile.repository.encryption.key.id. Previously-encrypted flowfile records can still be decrypted as long as that key is still available in the key definition file or nifi .flowfile.repository.encryption.key.id.<OldKeyID> as the key ID is serialized alongside the encrypted record.

Writing and Reading FlowFiles

Once the repository is initialized, all flowfile record write operations are serialized using RepositoryObjectBlockEncryptor (the only currently existing implementation is RepositoryObjectAESGCMEncryptor) to the provided DataOutputStream. The original stream is swapped with a temporary wrapped stream, which encrypts the data written by the wrapped serializer/deserializer via EncryptedSchemaRepositoryRecordSerde inline and the encryption metadata (keyId, algorithm, version, IV, cipherByteLength) is serialized and prepended. The complete length and encrypted bytes are then written to the original DataOutputStream on disk as normal.



```
11748 0A695616 FDACCB9A BB1242F5 258EBAA0 207B1D86 2A62000
11792 2E6E6966 692E7365 63757269 74792E72 65706F73 69746F7
11836 696F6E4D 65746164 61746136 C69C49D5 97A81F02 0000787
11880 63757269 74792E72 65706F73 69746F72 792E5265 706F736
11924 4D657461 64617461 9F432858 4EDFDF08 02000549 0010636
11968 6F726974 686D7400 124C6A61 76612F6C 616E672F 5374726
12012 056B6579 49647100 7E00024C 00077665 7273696F 6E71007
12056 6F506164 64696E67 75720002 5B42ACF3 17F80608 54E0020
12100 992A7F74 00024B31 74000276 3141E990 4557ECC2 5815447
12144 6BA62EAB 7D1179F5 A39DEF5A B9BCF174 4379AE7D 32E7F18
12188 CF84BF19 0EAFA3C5 14B6BF83 CF067577 885C34C2 0209069
12232 9766E76C A4A0D0A7 0D2808A1 B6A11DE9 D426D8C3 001112A
12276 1999C031 D13125B2 57A16737 24318CA6 A547FA98 12CB79E
12320 A4DD0000 0224ACED 00057372 00416F72 672E6170 6163686
12364 69746F72 792E626C 6F636B2E 426C6F63 6B456E63 7279707
12408 00007872 00466F72 672E6170 61636865 2E6E6966 692E736
12452 706F7369 746F7279 4F626A65 6374456E 63727970 74696F6
12496 00106369 70686572 42797465 4C656E67 74684C00 09616C6
12540 53747269 6E673B5B 00076976 42797465 73740002 5B424C0
12584 6E71007E 00027870 000000D1 74001141 45532F47 434D2F4
12628 54E00200 00787000 000010C6 8ADF06C7 E564EF65 1E451B2
12672 24A497A1 FB67CF78 36DA4CF7 9CC2E4EB 2A7438C2 50F415A
12716 B120656D 388407BD CCA28585 B66F26BA 370A3FED 5488EB9
12760 36A9219C 62835DCA AE5DD2EA 79069A62 2222D571 B86DD75
12804 049D7B3B A5C0214A F6E5098A 703B4022 0F8BFBE1 BCC9C35
12848 4B0EE409 9B926647 1D8723F0 3744A280 6824FE32 05AA263
```

On flowfile record read, the process is reversed. The encryption metadata (RepositoryObjectEncryptionMetadata) is parsed and used to decrypt the serialized bytes, which are then deserialized into a DataInputStream object.

During swaps and recoveries, the flowfile records are deserialized and reserialized, so if the active key has been changed, the flowfile records will be re-encrypted with the new active key.

Within the NiFi UI/API, there is no detectable difference between an encrypted and unencrypted flowfile repository. All framework interactions with flowfiles work as expected with no change to the process.

Potential Issues

Note: Switching Implementations

It is not recommended to switch between any implementation other than SequentialAccessWriteAheadLog and the EncryptedSequentialAccessWriteAheadLog. To migrate from a different provider, first migrate to the plaintext sequential log, allow NiFi to automatically recover the flowfiles, then stop NiFi and change the configuration to enable encryption. NiFi will automatically recover the plaintext flowfiles from the repository, and begin encrypting them on subsequent writes.

- Switching between unencrypted and encrypted repositories
  - If a user has an existing write-ahead repository (WriteAheadFlowFileRepository) that is not encrypted (uses the SequentialAccessWriteAheadLog) and switches their configuration to use an encrypted repository, the application handles this and all flowfile records will be recovered on startup. Future writes (including re-serialization of these same flowfiles) will be encrypted. If a user switches from an encrypted repository to an unencrypted repository, the flowfiles cannot be recovered, and it is recommended to delete the existing flowfile repository before switching in this direction. Automatic roll-over is a future effort (NIFI-6994) but NiFi is not intended for long-term storage of flowfile records so the impact should be minimal. There are two scenarios for roll-over:
    - Encrypted # unencrypted - if the previous repository implementation was encrypted, these records should be handled seamlessly as long as the key provider available still has the keys used to encrypt the claims (see Key Rotation)
    - Unencrypted # encrypted - currently handled seamlesssly for SequentialAccessWriteAheadLog but there are other initial implementations which could be handled
  - There is also a future effort to provide a standalone tool in NiFi Toolkit to encrypt/decrypt an existing flowfile repository to make the transition easier. The translation process could take a long time depending on the size of the existing repository, and being able to perform this task outside of application startup would be valuable (NIFI-6994).
- Multiple repositories - No additional effort or testing has been applied to multiple repositories at this time. Current implementations of the flowfile repository allow only for one repository, though it can reside across multiple volumes and partitions. It is possible/likely issues will occur with repositories on different physical devices. There is no option to provide a heterogenous environment (i.e. one encrypted, one plaintext partition/directory).
- Corruption - when a disk is filled or corrupted, there have been reported issues with the repository becoming corrupted and recovery steps are necessary. This is likely to continue to be an issue with the encrypted repository, although still limited in scope to individual records (i.e. an entire repository file won't be irrecoverable due to the encryption). It is important for the continued operation of NiFi to ensure that the disk storing the flowfile repository does not run out of available space.

Experimental Warning

While all Apache licensed code is provided "on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied" (see Apache License, Version 2.0), some features of Apache NiFi may be marked experimental. Experimental features may:

- have undergone less extensive testing than is normal for standard NiFi features
- interact with unstable external dependencies
- be subject to change (any exposed APIs should not be considered covered under the minor release backward compatibility guidelines of Semantic Versioning)
- potentially cause data loss
- not be directly supported by the community in the event issues arise

Every attempt is made to provide more detailed and specific information around the nature of the experimental warning on a per-feature basis. Questions around specific experimental features should be directed to the Apache NiFi Developer Mailing List.

Other Management Features

In addition to the Summary Page, Data Provenance Page, Template Management Page, and Bulletin Board Page, there are other tools in the Global Menu (see NiFi User Interface) that are useful to the DFM. Select Flow Configuration History to view all the changes that have been made to the dataflow. The history can aid in troubleshooting, such as if a recent change to the dataflow has caused a problem and needs to be fixed. The DFM can see what changes have been made and adjust the flow as needed to fix the problem. While NiFi does not have an "undo" feature, the DFM can make new changes to the dataflow that will fix the problem.

Select Node Status History to view instance specific metrics from the last 24 hours or if the instance runs for less time, then since it has been started. The status history can help the DFM in troubleshooting performance issues and provides a general view on the health of the node. The status history includes information about the memory usage and disk usage among other things.

Two other tools in the Global Menu are Controller Settings and Users. The Controller Settings page provides the ability to change the name of the NiFi instance, add comments describing the NiFi instance, and set the maximum number of threads that are available to the application. It also provides tabs where DFMs may add and configure Controller Services and Reporting Tasks. The Users page is used to manage user access, which is described in the System Administrator’s Guide.